WORLD OIL

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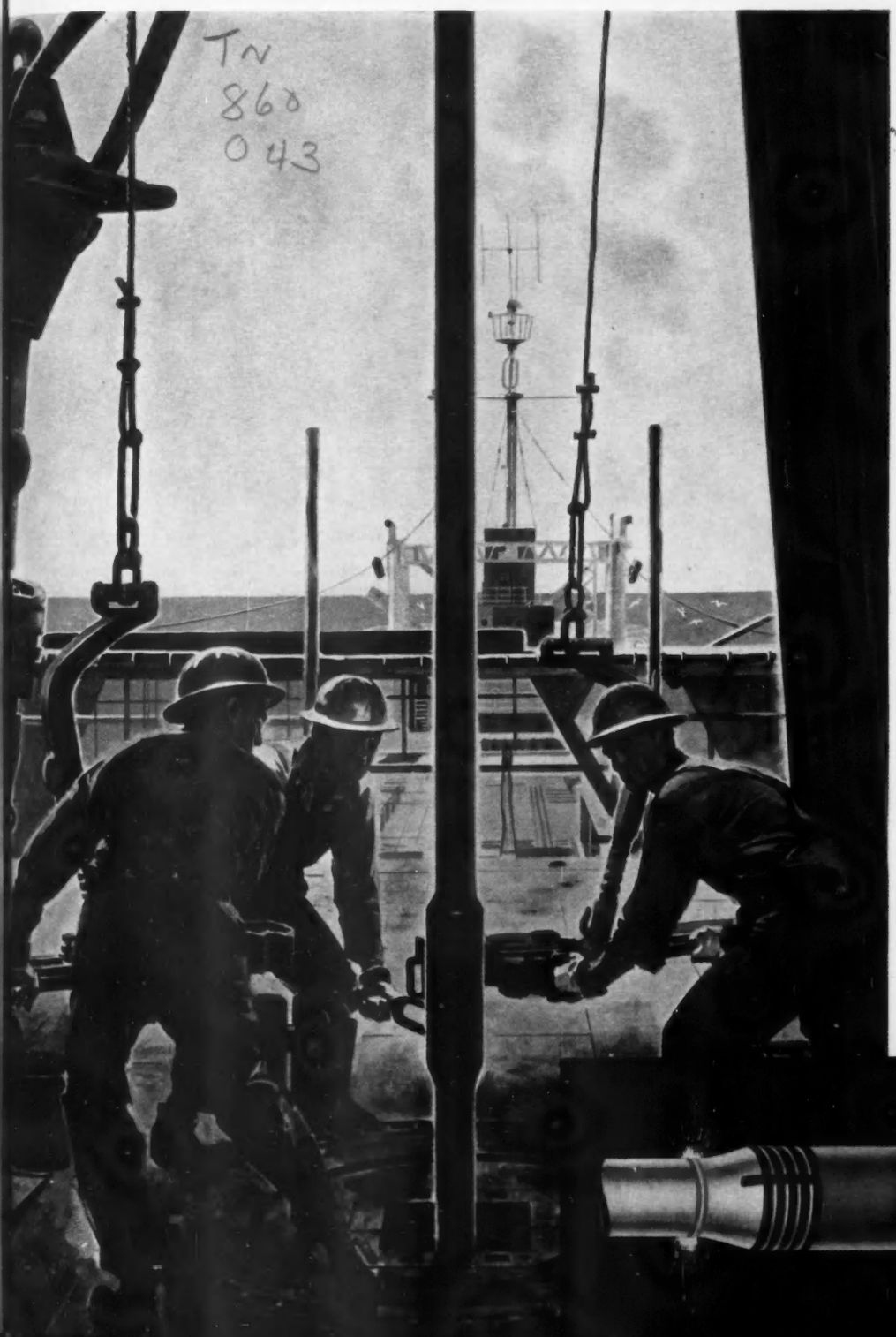

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Volume 143, No. 7 December, 1956

WORLD OIL

Established 1916 as The OIL WEEKLY

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a quick look at WORLD OIL this month

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following pages, checking ☑ those you want to read first.

☐ **If Oil Could Speak** it would have many fascinating truths to tell the non-oil public—truths that would win thousands of new friends for the oil industry. BUT, oil can't speak—you can. You, as an individual can win many new friends for the oil industry if you will pass the true facts on to your oil industry friends. This article—the first of a series—appears on **Page 102** for one purpose: To equip you with as many facts as possible about your industry, so you can tell the story oil is unable to relate. Be sure to read **If Oil Could Speak.** You will find it informative—and interesting.

☐ **Suez Canal stoppage** is going to have a widespread effect. There are not enough tankers to transport the huge volumes needed by Western Europe and North Africa from the Middle East around the Cape of Good Hope. This will necessitate a vast reshifting from normal tanker routes. The economies of many nations will feel the influence. The Middle East producing countries and companies will be vitally af-

Turn the Page ▸

THIS MONTH . . .

fected. These are all immediate results of the Suez Canal stoppage. But in the long run the present crisis will speed up steps to lessen the dependence of the world upon the Suez Canal. Super tankers sailing around the Cape of Good Hope to the West offer the best future, and a permanent remedy to the Middle East oil transportation problem. They do not face political insecurity, and are free of tolls and restrictions. See **page 76. Suez Stoppage to Have Worldwide Effect**.....**H. K. V. Tompkins**

☐ **Tankers are destined to play an increasingly important role** in world transportation of petroleum. World demand for oil is steadily increasing. To supply the demand, there will be increased production, especially in the prolific Middle East. The fields of that region are so located that a large part of their oil will go to market in tankers. The dominance of the Middle East in the future world oil trade assures heavy demand for tanker transportation. During the coming decade, a vigorous tanker building program will be necessary. More tonnage must be built than in the past decade. To meet the tanker requirements it apparently will be necessary to build additional shipyards. The existing shipyards are booked up far ahead. **Tanker Role Looms Large in Future Oil Transportation** .....**Page 80**

☐ **The U. S. Petroleum industry in 1957** will be called on to supply 9,598,000 barrels per day of all oils for domestic consumption and export, it is forecast. That would be an increase of 371,000 barrels daily or 4.0 percent over 1956. Domestic demand will average 9,265,000 barrels a day, up 366,000 barrels or 4.1 percent. Exports will average 333,000 barrels daily, about the same as in 1956. Crude production in the U. S. will need to average about 7,309,000 barrels daily in 1957, an increase of 2.6 percent, it is indicated. Crude runs to stills will approximate 8,221,000 barrels daily, up 3.2 percent over 1956. In the five years from 1957 to 1962, total demand for all petroleum is expected to increase at an annual average rate of 3 percent. **Oil Demand to Rise 4% in 1957**.....**Page 83**

☐ **Two vital factors** can determine success or failure of a given project. *Planning* and *control* of capital expenditures. Here is an information-packed survey report on the way 15 oil companies plan and control capital expenditures. Check and see how your accounting methods compare. **Page 88. How 15 Companies Handle Capital Expenditures**.....**G. E. Kiser**

☐ **U. S. crude oil markets,** quite shaky until a month ago, now are firm and due to grow stronger. Large scale export buying, running into the millions of barrels, will soon relieve the U. S. of surplus crude supplies. This sudden shift is the result of disrupted Middle East shipments to Europe, due to blockage of the Suez Canal. See **Page 104. Export Buying Improves U. S. Oil Outlook**.....**Ray L. Dudley and Warren L. Baker**

EXPLORATION ARTICLES

☐ **WORLD OIL called upon members** of the seismologists profession to assist in the development of a progress report on magnetic tape recording. Recent field developments, laboratory findings and methods of data compilation will be seen in the resulting special report, **Page 111. Magnetic Tape Recording Gains Popularity** .....**Alan Waldie, Thomas Moore and Hal Jones**

☐ **The conclusion that alteration** represents the cumulative effects of geothermal variation at the surface over geologic time is developed in Part 2 of **Earth Temperatures, Alteration Studies Reflect Subsurface Structure by Bernard H. Lasky**.....**Page 116**

DRILLING ARTICLES

☐ **Intensified offshore geophysical exploration** has prompted the introduction of a number of radically new instrumentation methods. Designed to speed overall survey activity, to cut down operating costs, and to provide the operator with a more accurate geophysical interpretation, these new methods have made offshore prospecting more attractive to the producing companies. For a look at methods currently employed by the offshore prospector, turn to **Page 122. New Techniques in Marine Geophysics**.....**T. R. Goedicke and E. R. Locke**

☐ **Who invented the turbodrill? Is it a new idea?** How does it compare with modern rotary drilling? Will it ever replace the present rotary method? These and other questions are answered on **Page 131. Turbodrill Development—Past and Present**.....**J. H. Thacher and W. R. Postlewaite**

WORLD OIL, published every month except semi-monthly in February and August. Entered as THE OIL WEEKLY as second class mail matter December 23, 1916, at postoffice at Houston, Texas, under the act of March 3, 1879.

THIS MONTH . . .

☐ **Despite iron-curtain secrecy and vague operational reports** the drilling industry is constantly hearing of the exceptional feats attributed to turbine drilling. To see how a german scientist pieces together various bits of sketchy information for an evaluation of drilling, see **Page 144. Increased Drilling Rates with Turbo-Drills**.....**Dr. Ing. W. Gronemeyer**

☐ **Forty of the much publicized Russian turbodrills** are now in Dallas undergoing orientation tests. As soon as operators are trained, field tests between the turbos and American rotaries should provide interesting comparisons and determine the merits of turbo drilling. For some of the reasons behind the acquisition of these turbos, read **Russian Turbodrills . . . How Good Are They?**.....**Page 151**

☐ **In the hard formations of the Permian Basin** air drilling is still setting records. A recent comparison in New Mexico between two mud drilled wells and an air drilled well shows that air drilling improved on the best mud drilled well by bettering the penetration rate 50 percent while using 58 percent less bits. For further comparison on these wells and the type of equipment employed, turn to **Page 162. Air Drilling Sets Record in New Mexico**.....**Peck Reaves and Bill Bachman**

PRODUCTION ARTICLES

☐ **Basic calculations for the proper selection** of unit pumpers and prime movers will help you in the selection of equipment. Part II is presented for use by the beginner as well as the experienced hand. For details see **Page 167. Solve Your Own Unit Pumper and Prime Mover Problems**.....**Tom H. Fraser**

☐ **Oil field electrification is moving ahead** at a rapid pace. In the Southwest alone it is estimated that by 1960 over 128,000 wells will be electrically equipped. If this trend is widespread, you may need to know these details supplied on **Page 169. Why the Trend Toward Electrified Leases?**.....**J. H. Day**

☐ **Tubing guns are one of the more recent tools** put to work in the petroleum industry. The value of the tubing gun, its advantages and limitations will be of interest to progressive production men. This, together with photographs and specifications for most of the available guns, should be in your files. For a good look at the tubing gun, see **Page 178. Why Not Use A Tubing Gun?**.....**G. H. Tausch**

☐ **Busy oil men will find this review extremely helpful.** Based on a literature survey preceding experimental work, it covers clay minerals and their effect in petroleum production. Get the benefit of many articles from this one. **Page 186. How to Identify Clay Minerals . . . and Why**.....**John F. Noonan**

☐ **The depletion of U. S. reserves might be delayed** for a considerable time by the 100 billion barrel reserve in the Colorado oil shale. A detailed report of this reserve, together with information on the type of oil produced and the general production methods used, should be of interest to anyone in the petroleum industry. For details see **Page 194. Don't Overlook Oil Shale**.....**Earl Trager**

INTERNATIONAL ARTICLES

☐ **Japanese oil technicians are touring the world's oil centers** in an effort to keep abreast of current progress in all phases of the oil industry. Paralleling this program is a trend toward increased drilling and use of conservation practices. For a current report on the nation, its fields and production, see **Page 203. Japan Stepping Up Drilling Program and Conservation**.....**A. B. Waters**

☐ **For a discussion of the significance** of the new major discovery of oil in Iran, see **Page 206** and the WORLD OIL interview with an official of the National Iranian Oil Company. **What's the Significance of Iran Discovery?**.....**Don Kliewer**

☐ **Now that oil moving out of the ports of La Salina and Maracaibo** no longer must be reloaded for shipment to the world's deep water facilities thanks to the completion of a 35-foot deep channel into Venezuela's Lake Maracaibo, development in Western Venezuela is expected to be accelerated. **See New Deep-Water Channel in Venezuela To Be Dedicated**..... **Page 208**

☐ **While ruthless exploitation of Hungarian natural resources** has created a deep anti-Russian feeling on the part of this satellite's citizens, the oil industry has achieved a successful position. Almost all

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THIS MONTH . . .

domestic crude requirements are met by the nation's oil industry, which has discovered new crude producing areas. For a field-by-field report on current producing areas, for an evaluation of new discoveries and for a look at the industry as a whole, see **Hungary Producing Most of Its Domestic Oil Needs** . . . . . **Page 213**

NEXT MONTH

EACH YEAR, the oil industry spends millions of dollars in direct costs due to corrosion. New ideas . . . methods . . . better ways of combatting corrosion are always at a premium.

And WORLD OIL editors have concentrated their efforts to bring you a roundup of top-notch articles on corrosion control. Articles by men who know a lot about corrosion—especially how to cut it down to size. You'll find this valuable information in WORLD OIL's big January Issue.

For instance, here's just part of the information you can use:

- **How to paint a drilling rig . . .** describes different types of paint bases to be used on various parts of a rig—depending on type of service.
- **How to provide splash zone protection for offshore drilling structures . . .** deals with process of monel cladding legs of drilling structures. You get results obtained.
- **How to protect offshore drilling equipment from saltspray corrosion . . .** tells you how different parts of drilling equipment such as drawworks and rotary table are being protected against corrosive weather conditions in offshore drilling.
- **Cause, effect and control of external casing corrosion . . .** shows you types of casing corrosion. Explains measurement of Electrochemical corrosion . . . determination of current requirement . . . and much more. You get problems in use of cathodic protection.

Plus . . . an extensive explanation of corrosion in pumping wells and a new method of corrosion inhibitor application in pumping wells. We think this material will really help you to take a healthy swing at knocking down corrosion costs.

So . . . be sure to look for your January issue and some real down-to-earth money-saving information.

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PETROLEUM REFINER and THE REFINERY CATALOG for the refining-natural gasoline-petrochemical industry.

PIPE LINE INDUSTRY and the PIPE LINE COMPOSITE CATALOG (first edition to be issued in July, 1957) for the oil and gas pipe line industry.

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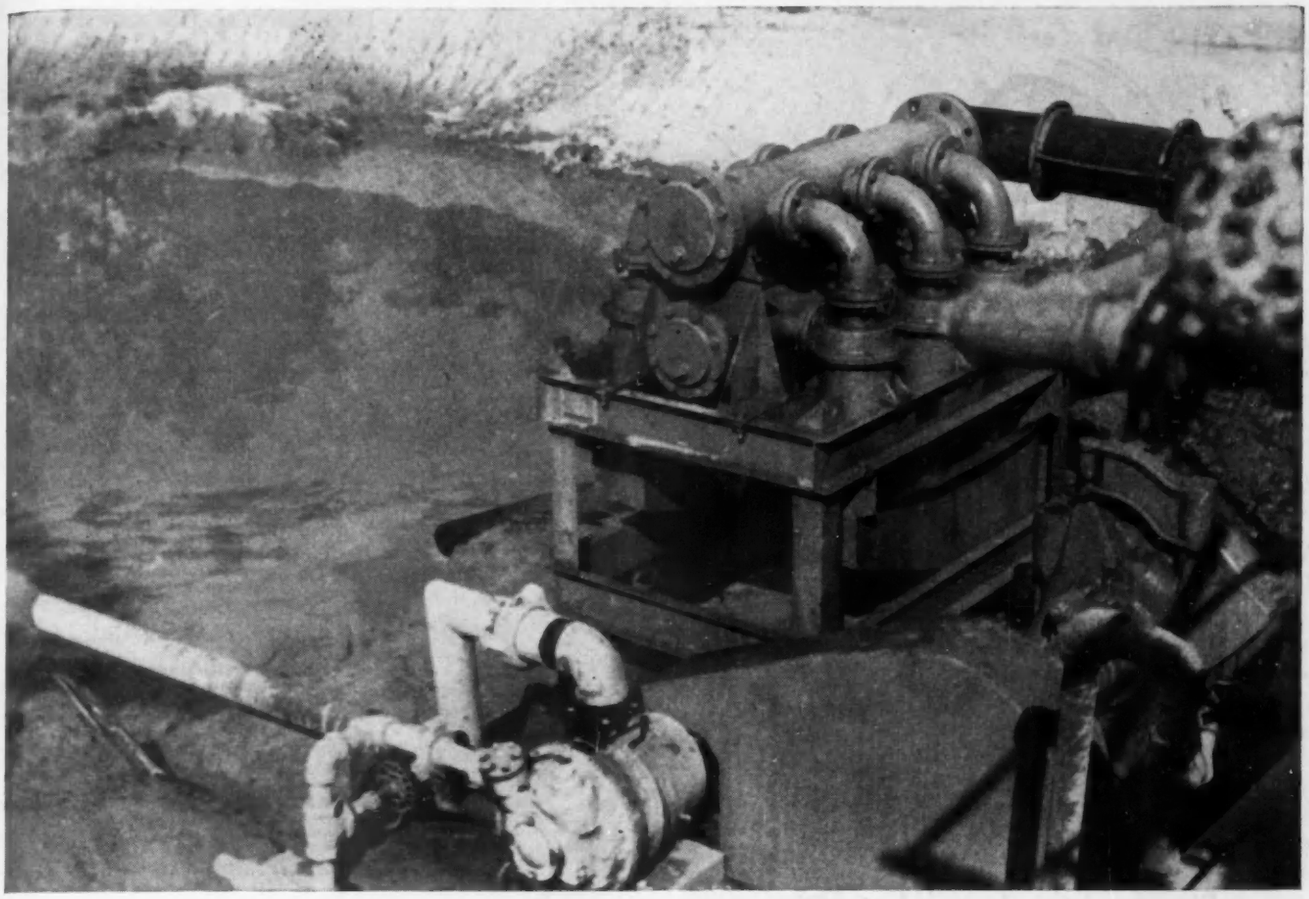

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WHO'S MEETING WHERE

NOV. 29–Dec. 15	Indian Industries Fair, New Delhi.
DEC. 2– 4	Oil Company Magazine Editors and Related Publications 2nd Annual Conference. Austin, Texas.
3– 4	New Mexico Oil & Gas Association, Annual Meeting, Alvarado Hotel, Albuquerque, New Mexico.
6– 8	Interstate Oil Compact Commission, Annual Meeting, Fontainebleau Hotel, Miami Beach, Fla.
13–14	Mid-Continent Oil & Gas Association Annual Advalorem Tax Forum, Hilton Hotel, Fort Worth, Texas.
16–18	Kansas Independent Oil & Gas Association, Annual Meeting, Broadview Hotel, Wichita, Kansas.
Jan. 30–31	College-Industry 9th Annual Conference
30–31	Relations-with Industry Division of American Society for Engineering Education 9th Annual College-Industry Conference, University of California, Los Angeles.
1957 FEB. 24–28	AIME, Annual Meeting, Roosevelt and Jung Hotels, New Orleans.
MAR. 6– 8	API, Southwestern District, Statler-Hilton, Dallas.
13–15	Society of Exploration Geophysicists, Hotel Texas, Fort Worth, Texas.
20–22	API, Division of Production, Southern District Meeting, Washington-Youree and Captain Shreve Hotels, Shreveport, La.
APRIL 1– 4	AAPG, National Convention, Kiel Auditorium, St. Louis.
6–11	Petroleum Equipment Suppliers Association, Palm Springs, Calif.
10–12	API Division of Production, Mid-Continent District Meeting, Mayo Hotel, Tulsa.
16–18	National Petroleum Assn., 54th Semi-Annual Meeting, Cleveland, Ohio.
24–26	API Division of Production, Rocky Mountain District Meeting, Gladstone, Townsend & Henning Hotels, Casper, Wyo.
28–30	Independent Petroleum Assn. of America, Midyear Meeting, Buena Vista Hotel, Biloxi, Miss.
May 1– 3	API Division of Production, Eastern District Meeting, William Penn Hotel, Pittsburg.
6– 8	American Geophysical Union, 38th Annual Meeting, Washington.
16–17	API, Pacific Coast Division of Production District Meeting, Biltmore Hotel, Los Angeles.

Nomads' Chapter monthly meeting: Los Angeles, second Wednesday, Jonathan Club, Wallace A. Sawdon, Secretary. Houston, second Monday, Ye Old College Inn, Harry E. Estes, Secretary. Dallas-Fort Worth, first Monday, Greater Dallas Club, Hank Davis, Secretary. Tulsa, Hotel Tulsa, Gilbert Swift, Secretary. New York, first Monday, Hotel Biltmore, Jesse E. Hickman, Secretary.

Looking Ahead . . .

. . . **U. S. oil and gas producers will be able to satisfy all of the nation's petroleum requirements,** "for whatever period imports of foreign oil may be reduced or unavailable" because of the interrupted flow of Middle East oil, declared Robert L. Wood, president of the Independent Petroleum Association of America. He stressed the importance and value of the present shut-in domestic producing capacity amounting to about 2 million barrels daily, "which domestic producers have built up despite inadequate funds and markets resulting from excessive imports." Wood pointed out the wisdom and need for policies that prevent dependency on foreign oil sources and that will continue to keep the domestic industry in a position to meet any emergency. The present situation, said Wood, involves no possible need for oil rationing in the U. S.

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. . . **More shipyards are now needed.** They must be built in order to increase tanker construction. Present orders for new tankers have all the world's existing shipyards booked up well into the future.

•

. . . **The business outlook remains favorable** in spite of the serious international troubles. Volumes of business are expected to continue good in most lines. For the petroleum industry, 1957 promises to bring normal increases in demand for oil.

•

. . . **Earnings of oil companies probably will continue comparatively good.** They have been aided so far this year by record breaking volumes of demand for oils. Further aiding profits lately have been the moderate increases in prices of fuel oils and heavier crudes. For 1957 additional growth in demand for petroleum is in prospect. Prices promise to continue firm because of tight supplies.

•

. . . **Some companies henceforth may find themselves in serious difficulties** because of lack of precautions taken by their young, inexperienced managements. This warning was given by H. H. Heimann, executive vice president of the National Association of Credit men. He declared "business operation has not been too difficult" in the last 25 years. Business practice has not had to face rugged competition and necessity of cutting costs. Formerly, he said. "wise management usually planned its plant and equipment expansion in a period of adjustment," to take advantage of lower costs and plentiful labor. It also "expanded inventory holdings when prices were attractive." Wise management also borrowed funds, he said, when interest rates were low, even when there was no immediate need for the money.

. . . **It will continue harder and more costly to borrow money.** There is "no prospect for a shift to easier money in the near future," recently stated W. Randolph Burgess, Undersecretary of the Treasury. "There's a tremendous demand for money, and savings aren't sufficient to meet it. We'll have to restrict demand for capital and increase savings."

•

. . . **The present Middle East crisis will stimulate oil exploration in the Western Hemisphere** and stop excessive U. S. imports of Middle East crude. These are the indicated two most profound effects of the crisis, both very long range in scope. So predicts the Value Line Investment Survey of Arnold Bernhard & Company, New York. In the search for oil, emphasis will shift to undeveloped areas in Canada, Latin America and the tidelands, says the report. And there will be "an end to the encroachment of Mideast crude into the U. S. domestic market, even after transportation arteries are restored to full use. Crude imports from the Near East will never again be permitted to rise to a level that seriously pinches the domestic producing industry. Some agreement will be reached that sets forth the proper share of the domestic markets which imports should enjoy."

•

. . . **U. S. business so far has not modified optimistic planning** because of international developments. Companies plan to spend somewhat more for expansion in 1957 than in 1956, though this year's sharp increase will not be equaled. In some lines, activity will be stepped up because of Middle East events. Tanker construction is being accelerated, causing increased demand for structural steel and more borrowing of scarce money. Steel mills are operating full blast, and steel companies doubtless will actively push plant expansion. The petroleum industry has been given strong incentive to expand drilling and other development in the U. S., Canada, Venezuela, and other areas of the Western Hemisphere.

•

. . . **The Free World has been hurt more by Middle East turmoil than many people realize,** says John G. Winger, economist, in Chase Manhattan Bank's latest monthly petroleum report. Oil is the "life blood" of the economies of countries of the Middle East as well as Western Europe, he states. Current blocking of the flow of Near East oil to Europe seriously retards Middle East development while slowing the wheels of industry in Europe. The bulk of oil use in Europe is for industrial and commercial activity, and very little of it is non-essential.

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If World War II didn't teach the American government and people the value of having a strong domestic oil industry, then events which have been occurring in the Middle East recently should bring the lesson strongly before us.

It is not enough that the oil companies, American and others, having properties in the Middle East should have the good will of the Arabic nations. We think that the oil companies have so conducted themselves as to earn the respect and good will of the nations in which they produce oil.

We do not believe that any Middle East government having oil or through which oil lines traverse, had a part in the sabotage of the oil pipe lines.

But when an irresponsible, malicious upstart like Dictator Nasser, who disregarded a treaty respected by his government for 90 years, can successfully urge the destruction of the oil lines *in other countries,* oil supplies for Western Europe come in for sober study. Dependence of Western Europe on Middle East pipe lines and the Suez Canal in times of war are cause for real concern in the U. S. and all other peoples of the Free World.

•

No, we are not proposing that the Middle East be ruled out of participation—even in American affairs. Nor are we suggesting that imports of oil into the U. S. be stopped. Anybody who would suggest that is not thinking straight. The U. S. needs oil imports, but we also need to have a sound, healthy oil industry in these United States. The United States of America furnished a great part of the oil with which World War II was won. And, as this is written in early November, it is not unreasonable to expect she may be called upon to help supply Western Europe with necessary oil.

We believe that the imports of recent months have been excessive. Whether the ratio of imports to U. S. crude oil production (with certain exceptions relating to Venezuela and residual fuel) imposed by the Office of Defense Mobilization some time ago should have been 16 or some other percent we can now determine probably better than was the case at the time it was made. We do not presume to say just how much can be imported without damaging the health of the domestic oil industry.

The figure of imports having a relation to 16 percent of domestic production was determined at a previous conference but it has not been enforced. It was done in the nature of a gentleman's agreement and we are not saying that somebody present forgot to be a gentleman! Or even that more than one forgot!

•

But the subject is so important that the very best brains of the industry—no firebrands on either side—should be called together by our government to work toward a solution to this problem. There *must* be some figure at which imports can be brought in without damage to the domestic industry. And it should be enforced. Such a meeting should convene in the serious consideration that a healthy domestic oil industry is imperative to the safety of not only our country, but her allies.

Ray L. Dudley

Bottom-to-Top Opportunities

YOUNG MEN of integrity, initiative, loyalty and education, who have cast their lot with the oil industry, can get a real thrill from two pages of the Mid-Year issue of *The Texaco Star!* Most people in the oil business know that the industry awards its competent men but *The Texaco Star* told of:

. • The retirement of a chairman of the board who had gone to work for The Texas Company as a lube salesman.

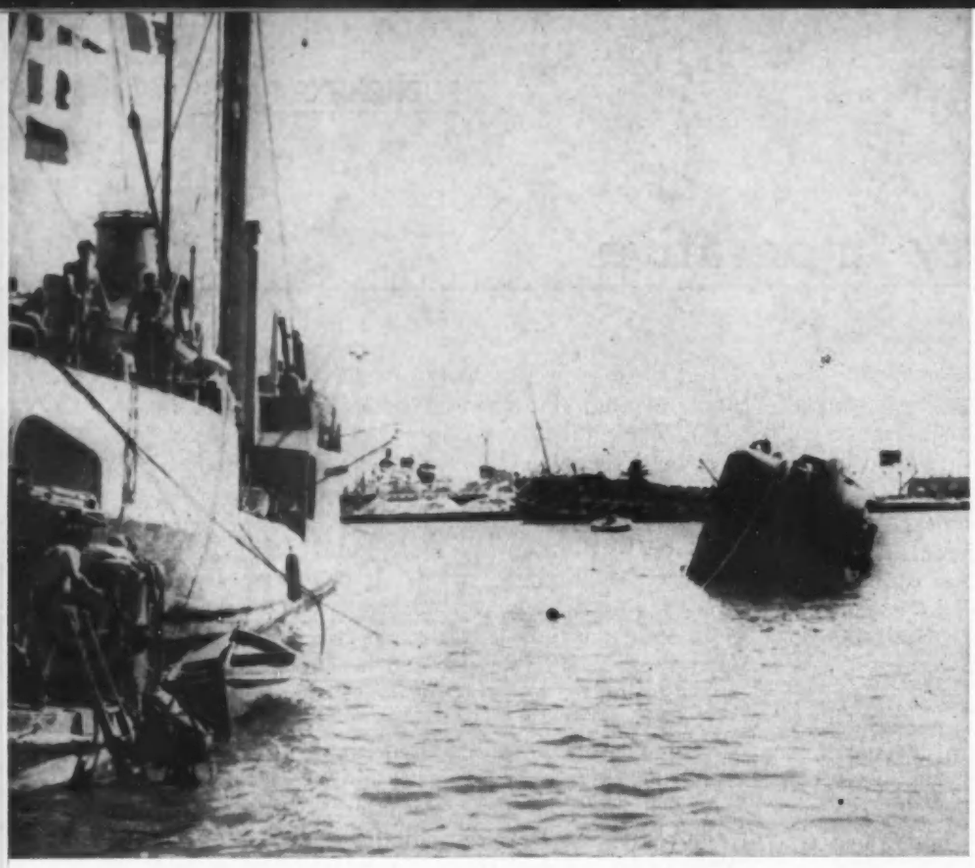
• The elevation to the chairmanship of the board of a man who during the depression went to work for the company as a service station supervisor, and

• The promotion to the presidency of a man who went to work for the company as a rotary rig helper.

True, these men had good educations but they went to work at the bottom and their loyalty to company interests, their native competence and their energy put them to the top without wealth—or pull.

The man retiring is chairman J. Sayles Leach, who received an award from the Texas Mid-Continent Oil & Gas Association as a man who had made real contribution to the industry. The new chairman is Augustus C. Long, and the new president who succeeded Long in that position is James W. Foley.

Power to them all as living examples of the way a free democracy, with free enterprise, works!



Efforts to reopen the Suez Canal were continuing late in November. Men in small boat at left watch as diver goes down in Port Said harbor, Egypt, to inspect sunken ships blocking the canal. Vessel at left is British tender *Kingarth*.

Suez Canal Is Blocked . . . Effect to Be Worldwide

All phases of the industry in all parts of the world will be affected in some way. Super-tankers appear to offer the best long-range permanent solution.

By H. K. V. TOMPKINS,
Houston.

THE SUEZ CANAL stoppage will have a tremendous effect on the world oil situation. It will affect all four vital elements of the oil business (production, transportation, refining and marketing). The breakdown or disruption of one vitally affects the other three. Stoppage of the Suez Canal directly affects transportation, hence all four will be affected.

The effects will be worldwide. Petroleum products are vital to the economy today of most parts of the world. Stoppage of the Suez Canal will necessitate a vast worldwide shifting from normal transportation routes. Many areas may feel the influence of these moves. Other parts of the world, notably the Western Hemisphere, will be called upon to produce more oil. The amount will depend upon the ability to reroute sufficient tankers and the ability of different countries to move oil to seaports.

Large Amount of Oil Involved

Directly involved are the large quantities of Middle East oil that formerly moved by tanker through the canal and by Iraq pipe line to the Mediterranean Sea. Flow through the latter has ceased because of the destruction of two or three pump stations. In addition, shipments of Middle East oil to the Far East are likely to be affected.

In all something like 2,615,000 barrels per day of Middle East oil will be affected by the Suez Canal stoppage and disruption of Iraq pipe line service. To properly analyze the effect of the canal stoppage, it is necessary to study shipments of Middle East oil to many different areas and a number of factors.

1. Shipments to the Eastern U. S., Canada and South America from the Middle East (*average barrels daily*):

Eastern U. S.	275,000
Canada	30,000
South America	70,000
Total	375,000

This volume can be amply supplied from U. S., Canadian or South American production.

2. Middle East Shipments to Africa and Far East *(average barrels daily):*

Japan	130,000
India	90,000
Australia	100,000
Other Far East and Africa	300,000
Total	620,000

This oil can continue to be shipped from Persian Gulf ports (Iran, southern Iraq, Kuwait, Saudi Arabia, etc.) as it does not pass through the canal or any disrupted pipe line service. However, sufficient tankers must be available. Undoubtedly shipments will be curtailed, with tankers in this service diverted to transportation elsewhere in an endeavor to alleviate the more critical and important Western European situation.

3. Shipments to Europe and North Africa, exclusive of Britain and France *(average barrels daily):*

Italy	325,000
Belgium, Netherlands, and Luxemburg	270,000
Western Germany	130,000
Other Western Europe and North Africa	300,000
Total	1,025,000
Tapline to Mediterranean	325,000
Leaving shortage of	700,000

The Arabian government has prohibited shipments to Britain and France. The Lebanon government has prohibited pipe line shipments destined for Britain and France. Therefore, it is possible to divert Saudi Arabian oil which formerly went to Britain and France to other European and North African markets.

With stoppage of the Suez Canal, oil can be moved to Europe and North Africa by way of the Cape of Good Hope, from the U. S., or from South America. Sufficient oil can be moved to Western Europe and North Africa only if enough tankers are available, and if there is adequate transportation to tidewater in the U. S. and Venezuela.

4. Middle East Oil Shipments to Britain and France *(average barrels daily):*

Britain	470,000
France	450,000
Total	920,000

This oil must be supplied in the same way that oil is supplied to other European and North African countries, by tanker around Cape of Good Hope, from the U. S. or from South America. However, the production must come from Kuwait, Iran, or other Persian Gulf areas outside of Saudi Arabia.

Need for Additional Tankers

There are not enough additional tankers available to move Middle East oil around the Cape of Good Hope to Western Europe and North Africa. It is estimated that the additional distance would require 11½ additional days between Persian Gulf ports and Western Europe for the average tanker. This means 23 additional days per tanker for each round trip.

The average tanker will haul approximately 100,000 barrels of oil. Therefore, to move 920,000 barrels of oil daily to England and France via the Cape of Good Hope would require an estimated 212 tankers. In addition 700,000 barrels per day is needed by other Western Europe and North Africa. If this oil is shipped via the Cape of Good Hope an estimated 161 more tankers would be required.

These figures indicate that an estimated total of 373 tankers of 100,000 barrel capacity, or an equivalent number of larger or smaller vessels of faster or slower speed would be required to supply the 1,620,000 barrels needed by all of Western Europe and North Africa by way of the Cape of Good Hope.

While these figures on the need for additional tankers are estimates, they clearly show that an appreciable number would be involved.

Obviously, the world's tanker fleet does not have sufficient unused capacity to move this much oil to Western Europe and North Africa. Hence, because of shorter distances many tankers are expected to be diverted to the movement of U. S. and Venezuela crude to Western Europe and North Africa.

Financial Effects of Suez Stoppage

Tanker operating costs average around $2500 per day, to which must be added about $750 for fuel. This makes a total of $3250 per day.

If 23 additional days are required to move Middle East oil via the Cape of Good Hope, this would mean about $75,000 per tanker trip.

On this basis the increased cost for a 100,000-barrel tanker would be approximately 75 cents per barrel moved around the Cape.

This estimated additional cost would involve a huge sum of money if it were possible to move the needs of Western Europe and North Africa via the Cape of Good Hope:

- At 75 cents per barrel, the 920 barrels needed daily by Britain and France would involve $690,000 per day of additional cost.
- The 700,000 barrels of oil needed daily by other Western Europe and Africa would amount to $525,000 daily at 75 cents per barrel.
- The combined total additional cost for the 1,620,000 barrels daily oil requirements of all Western Europe and North Africa at 75 cents per barrel would total nearly $1¼ million per day.

This constitutes another reason for diverting tankers to U. S. and Venezuela ports in an effort to supply Western Europe and North Africa.

Even from the U. S. and Venezuela additional cost is likely, the basic price of oil being higher. On the other hand the economy of Western Europe will slow down vitally if it does not have enough oil. More than transportation will be involved. Manufacturing plants will close, homes will be cold, etc.

Effect on Middle East Countries

These countries were extremely poor before the development of their tremendous oil resources. Up until the Suez stoppage, they were receiving a very appreciable income due to their participation in the income therefrom. Their income from oil production and transportation fees would have amounted to over $1 billion in 1956 under normal conditions.

This income has vitally affected their economy and benefitted their well-being. Therefore, stoppage of production due to interruption of pipe line operations as in the case of Iraq, or curtailment of production due to canal stoppage in the case of other countries is a serious financial matter for all Arabian nations.

There is little demand for oil in these Middle East producing countries. Consequently, there is very little financial return from oil unless their production can be transported to international markets; no transportation of oil, no revenue therefrom.

Effect on Middle East Oil Companies

The financial stake of U. S. companies in the Middle East is very appreciable, as is the amount they have invested in Western Europe refineries and marketing facilities.

The Middle East countries did not contribute financially to the development of their oil resources. Private exterior enterprise contributed all finances. Unknown, undeveloped oil resources are of no value without the expenditure of knowledge, skill and money, and risks undertaken to explore, develop, transport, refine and utilize the oil.

The same thing applies to the British, Dutch and French concerns with investments in the Middle East.

Middle East companies will suffer financial losses due to disruption or reduction of production. They also are faced with the necessity of paying

higher tanker tolls even if they purchase oil from the U. S. or Venezuela to offset the inability to transport enough Middle East oil. However, this will probably be passed on to consumers.

Effect on Western Hemisphere Oil

The U. S. has ample producing ability of its own to offset the loss of any imports from the Middle East. Its loss will be represented by the financial losses incurred by its Nationals engaged in Middle East production and European refining and marketing operations. Many Americans will feel the effects, stockholders of these companies running into the hundreds of thousands.

The U. S. has adequate producing ability to provide much of the oil needed by Western Europe and North Africa, even though the amount involved may be appreciable. (See Page 104). However, the availability of tankers and pipe lines from oil fields to tidewater will be a limiting factor.

Many American producers are looking forward to the moving of enough oil to Europe and Africa to relieve surplus crude stocks and to result in increased production rates. However, U. S. reserves should not be used for this purpose. With its ever increasing domestic consumption, U. S. reserves will become increasingly vital to the future U. S. economy and security. Oil once used cannot be replaced.

(*WORLD OIL does not agree with the author at this point, believing that the U. S. should aid its allies in Western Europe in every manner possible —R.L.D., Publisher*).

The small amount of Middle East oil imported by Canada can be easily replaced from its own fields, or from the U. S. and Venezuela.

South America also can take care of its own needs, providing tankers are available. In fact, Venezuela can benefit through increased shipments to Europe. It has ample reserves to do this. However, Venezuelan oil is much more expensive than Middle East oil. The bottleneck here may be pipe line capacity. While Venezuela's pipe line capacity will be increased substantially during the next two or three years, it is questionable whether much additional capacity can be provided in time to help in the current Middle East crisis.

Suez History and Ownership

It is well to consider the history of the Suez Canal and its ownership, because the latter is the cause of the present situation.

Some are saying that the Panama Canal is a parallel condition. This is not true for many reasons. The Panama Canal occupies a territory known as the "Canal Zone", which was bought and paid for by the U. S. Government in a valid treaty and contract with the Panamanian government. Therefore, the Panama Canal, including a strip of shore land on both sides, is owned by the U. S. Government. Furthermore, the U. S. Government built, operates and maintains the Panama Canal at no profit.

The Suez Canal involves an entirely different set of conditions. It was built by the Suez Canal Company, a private stock company promoted and organized by the French. A contract was executed by the then rulers of Egypt (Turkey). The contract provided for the right to build a canal through Egypt and to operate it until 1968. Upon expiration of the contract all rights, title and interest in the canal was to revert to the Egyptian government.

Furthermore, the Suez Canal Company has no "zone" as does the Panama Canal. All facilities are located on Egyptian territory or lands.

Under the terms of the contract the then ruler of Egypt (a Turk) received 40 percent of the stock of the canal company as compensation for granting the right to build the canal through Egyptian territory. Subsequently, because he was in financial difficulties, the Turkish ruler sold his stock to the British Government. Today, the Suez Canal Company is owned by the British Government and private stockholders, principally French.

From the above it can be seen that there is no similarity between the Panama Canal and the Suez Canal Company.

The Suez Canal Seizure

It is not clear whether the Egyptians seized the canal with the intention of expropriating or confiscating it. There is a great deal of difference. Under international law expropriation is legal, while confiscation is not. A government has the legal right to expropriate a private company's holdings within its borders. Under an act of expropriation private companies are compensated for the value of their properties, while confiscation provides no compensation.

This is the *S. S. Veedol*, operated for Tidewater Oil Company, and an example of the new super-tankers built in recent years. Vessel is 733 feet long; has deadweight of 45,833 tons; a capacity of approximately 401,632 barrels, and displaces 58,882 tons.

The Egyptian government (as presently represented by Colonel Nasser) has not publicly made it clear that it would compensate the Suez Canal Company for the canal, although it was stated that revenues from the canal, which are very sizable, would go to pay for the building of the Aswan Dam on the Nile River.

There are several interesting phases in connection with the possible compensation for the canal. Payments would not be for the total value of the canal, but only for the 12 remaining years of the life of the Suez Canal Company's contract. Ironically, if the Egyptian government had only waited a few years all rights, titles, etc., to the canal would have legally reverted to them.

Many Operating Problems

The Egyptian government took over the operation of the canal under severe difficulties. It was feared they were not going to be able to operate it successfully. This is well illustrated by the fact that insurance rates were raised when they first took over the canal's operations. However, the rates dropped back to normal, evidencing satisfaction in the canal's operations. The normal passage of 40 to 50 vessels a day was proceeding satisfactorily.

However, news reports indicate that the short operation by the Egyptian government came at the best time of

Are Super-Tankers the Answer? . . . See Story on Next Page . . .

the year. There was a strong feeling that operation by the present native and foreign pilots, including a number of Soviets, would not be successful over a long period of time.

The Suez Canal is a narrow ditch through a sandy desert. It is expensive to maintain. Its conditions create a number of difficult operating problems. Skilled pilots and dispatching are required to keep 40 to 50 vessels moving through it safely and without delay.

Present Suez Conditions

At present the canal is blocked by sunken vessels, etc. It will take months of salvage work and considerable money to clear it.

Blocking of the canal is not only a serious matter with respect to oil shipments, but it is also a serious matter with respect to other vessels customarily using it to pass from east to west.

Vessels of many nations carry widely diversified and valuable cargoes of extreme importance to the well-being of many nations, both of the East and the West. Routing these around the Cape of God Hope involves additional expense and delay, even if additional shipping capacity is available. The hardships will be severe because there is insufficient shipping capacity.

Meanwhile, ownership of the Canal is uncertain. Who is going to own and operate it between now and 1968 is a question that remains to be settled. After 1968, as previously pointed out, ownership is scheduled to pass to the Egyptian government.

Suez Future Role

It is probable that the present Suez Canal will be unable to handle the future increase in world shipping which will be required of it. Furthermore, it already is unable to handle the increased size of vessels now in use and being built. Therefore, the Suez Canal in its present condition is faced with the definite possibility of becoming obsolete.

Under present conditions, who will provide the finances for increasing its width and depth? Would not this necessitate higher tolls? Would not an increase in tolls reduce its ability to compete with the route around the Cape of Good Hope? One of the reasons for building Tapline from Arabia to the Mediterranean was the savings effected by elimination of canal tolls.

Certainly, it may be concluded that the Suez Canal might become less important to world shipping in the future. This was true before the Egyptian government seized the canal. Now the clouded ownership strengthens the possibility that steps will be taken to lessen the dependence on the canal.

Present political conditions in the Middle East also may influence future pipe line construction in the area. There is no insurance that pipe line service will not be interrupted, nor that pipe line fees and rentals will be stable at economic levels.

Around the Cape of Good Hope

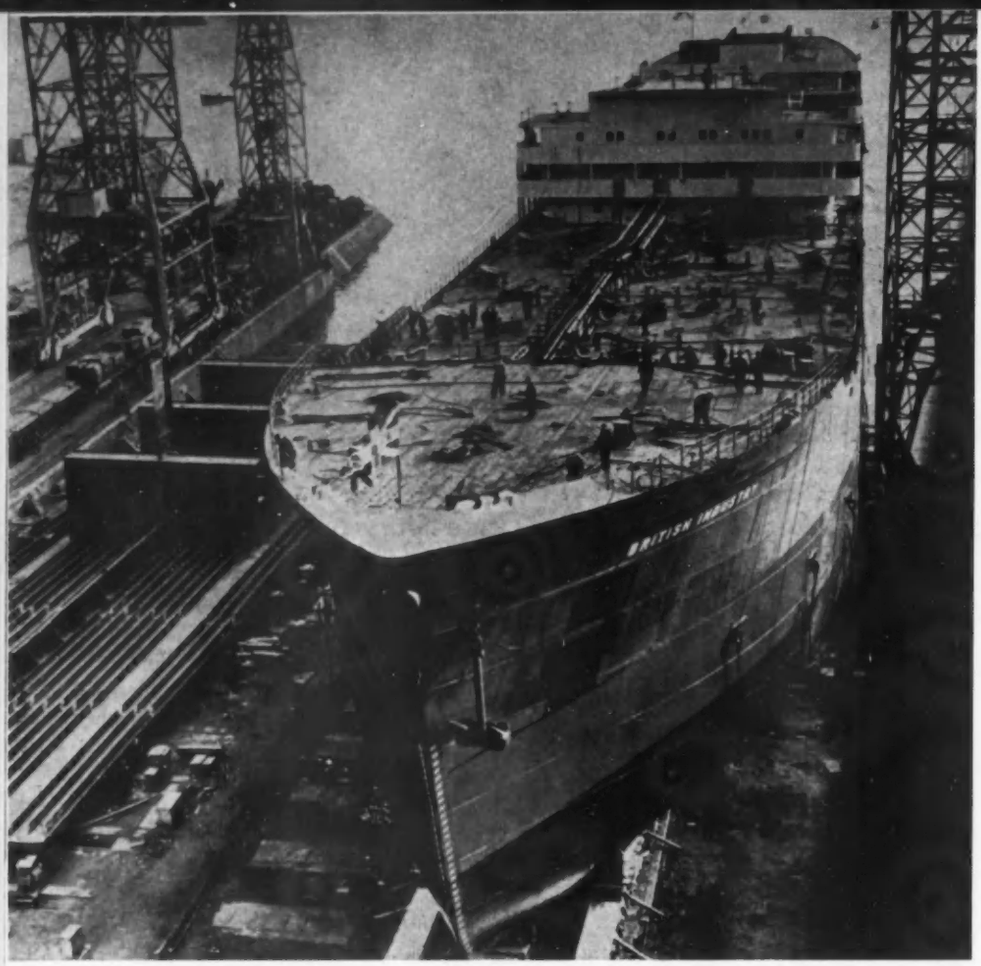
In view of the foregoing conditions, shipping around the Cape of Good Hope may be the logical solution. It offers none of the difficulties that would be faced by tankers using the Suez or by pipe lines passing through several countries.

Tankers transporting oil around the Cape of Good Hope from Persian Gulf ports have no political problems to contend with, because the seas are internationally free to all nations, free of tolls, and free of restrictions. The Persian Gulf area includes Saudi Arabia and Bahrein (100 percent U. S.), Kuwait (50 percent U. S.), Neutral Zone (100 percent U. S.), Iran (partly U. S.), southern Iraq (partly U. S.), and Qatar (partly U. S.).

While the average present-day tanker experiences greatly increased costs if routed around the Cape of Good Hope instead of the Suez Canal, this is not true of the new "super-tankers." Because of their size, design and operating features, the new "super-tankers" find it economical to use the Good Hope route. The present transportation of oil from Persian Gulf ports to the West by means of these "super-tankers" has been proven to effect a saving over the canal route. Consequently, there are a number of "super-tankers" under construction and on drafting tables.

Therefore, "super-tankers" sailing around the Cape of Good Hope to the West offer a future, permanent remedy to the Middle East oil transportation problem. They form a practical, economical, permanent solution to the problems now involving the transportation of oil from the Middle East. On the other hand the Suez Canal and pipe lines face political insecurity even if present problems can be settled. When all factors are considered, including the cost, is it not reasonable to invest in "super-tankers"?

Editor's Note: The author has been directly associated with the oil business, both in the U. S. and elsewhere, since 1917.



After being launched in October of this year, tanker *British Industry* moves down ways into the Clyde. This is the first of a new series of 32,000 deadweight tons oil tankers to be built for British Petroleum Company's shipping organization, BP Tanker Company. Company will include ships of 60,000 deadweight tons in next building program.

EDITOR'S NOTE: Nationalization of the Suez Canal by the Egyptian government has emphasized the growing importance of the tanker in the vital field of oil transport.

The development of the Middle East as a major source of world oil supply has increased the distance over which oil has to be carried.

During the next 20 years or so, some 80 to 105 million tons deadweight of shipping may need to be built to carry the world's oil requirements.

The article herewith is a study of present and future tanker operations and requirements. It is excerpted from a paper: "The Changing Pattern of World Oil Movements" presented at a meeting of The Institute of Petroleum in London. The excerpt is published in WORLD OIL by special permission of the author and the Institute of Petroleum.

Tanker's Role Looms Big In Oil Transport Picture

Greater volumes of oil must be handled in supplying growing world demand for it.

By W. JAMIESON
The British Petroleum Company, Ltd.,
London

THE TANKER method for transporting crude oil and petroleum products henceforth will become increasingly important. This is assured by the prospective further increases in oil demand throughout the world and the location of the world's proved oil reserves.

A large proportion of the oil reserves is concentrated in the Middle East, adjacent to the Persian Gulf. Much of that oil logically will move to market primarily in tankers.

To provide the necessary vessels, large scale construction of tankers will be necessary. The new ships will include many very large and relatively fast tankers in order to hold down the oil transportation costs.

Future Tanker Requirements. In the future the Middle East probably will play a larger part in supplying the oil requirements of both the Eastern Hemisphere and the West. The average distance oil will have to move by sea likely will continue to increase, therefore, even if new pipe line capacity is laid from the Persian Gulf to the Mediterranean.

In the past, extra oil carrying capacity per ton deadweight has been provided by stepping up the speed of tankers. But there is an economic limit to which the speed of tankers can be pushed. To provide the increased carrying capacity that will be needed in the future, more as well as faster tankers will be required. Construction of new tanker tonnage will need to be increased above the volumes of the past decade.

In estimating the size of the world's tanker fleet that might be necessary in the future, it has been assumed that the average speed of the world fleet will not rise above 15 knots. Since many small tankers will still be necessary at, no doubt, much slower speeds, this implies a large amount of tonnage at speeds above 15 knots.

On this assumption the amount of tanker tonnage that might be needed to move the world's oil in 1965 will be nearly 60 million tons deadweight, and in 1975 from 95 to 120 million tons deadweight. The amount will depend on whether pipe lines are built to the Mediterranean to carry oil beyond the estimated Suez Canal capacity or whether this oil has to travel via the Cape of Good Hope.

Allowing for scrapping of old vessels at 25 years of age, the total new building possibly facing the industry is 25 million tons deadweight between-

now and 1965 and from 55 to 80 million tons deadweight in the following decade. The future new building requirements compare with 22 million tons d.w. built in the past 10 years and with 14 million tons d.w. now on order.

The sharp rise in the 1965-1975 period is due to the assumption of a large increase in shipments from the Middle East to the Western Hemisphere and the fact that nearly 19 million tons d.w., including all the T-2s, will become due for scrapping in that period.

The anticipated growth in the volumes of oil to be carried will encourage the building of very large ships. But beyond the 30-40,000 ton d.w. size the number that can be used may be limited by lack of suitable ports and waterways.

World Tanker Fleet Has Grown. Some details of the world's tanker fleet for 1938 and post-war years are given in Table 1.

TABLE 1
World Tanker Fleet Vessels of 5000 D.W.T. and Over

As at December 31	Million Tons Deadweight*	Average Size	Approximate Average Speed Knots
1938	15.012	11,100	11
1948	23.468	13,450	12
1949	24.693	13,850	13
1950	26.648	14,150	13½
1951	28.800	14,350	13½
1952	31.605	14,600	13½
1953	34.546	15,200	13½
1954	38.038	15,850	14
1955	40.090	16,400	14

*Based on data provided by Messrs. John I. Jacobs & Co. Ltd.

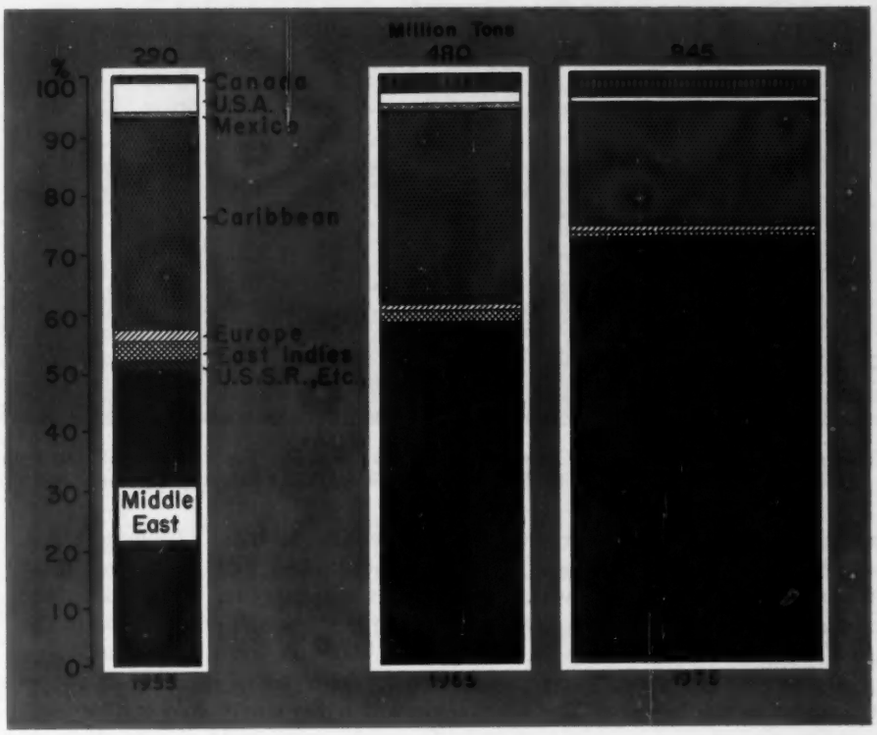
Measured in deadweight tons the fleet was by 1955 167 percent greater than in 1938 compared with an increase of 200 percent in the total ton-miles of oil carried at sea.

The over-all efficiency in the employment of the tanker fleet for any period is difficult to assess because of insufficient data on the many factors involved. Some ships are laid up from time to time. Some may be diverted to other bulk liquid trades. Some, especially government owned ships, may not be fully employed. Speed at sea, turnaround times, delays due to weather, dock availability or mishaps all differ with each ship and from voyage to voyage. The proportion of time spent on ballast runs varies with the routing of tankers. Time out of service for repair is not constant. Cargo carrying capacity depends not only on the season and voyage but also on individual operators' bunkering policy.

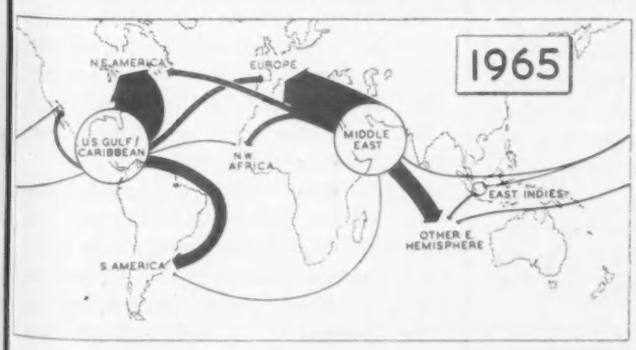
It is equally difficult to measure the work done by the world's fleet. The increase in total ton-miles given above is based on an assessment of only the major oil movements. The comparison between the simple growth in deadweight tons and the work done is not strictly valid. The apparent saving which is shown in this comparison is, however, closely related to the increased annual carrying capacity of tankers due to higher speeds and faster turnaround times. On speed alone the fleet today can deliver about 20 percent more cargo per ton deadweight per annum than the fleet in 1938.

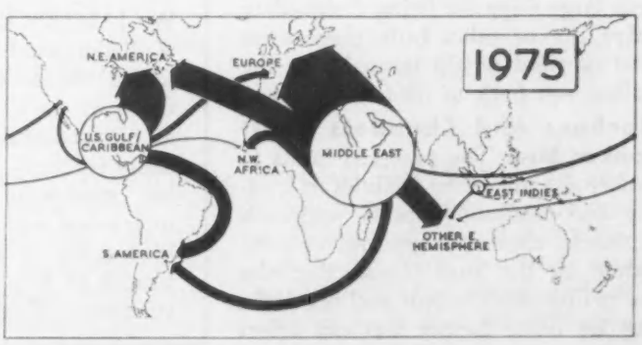
Tankers Being Built Larger. The average size of tanker has also in-

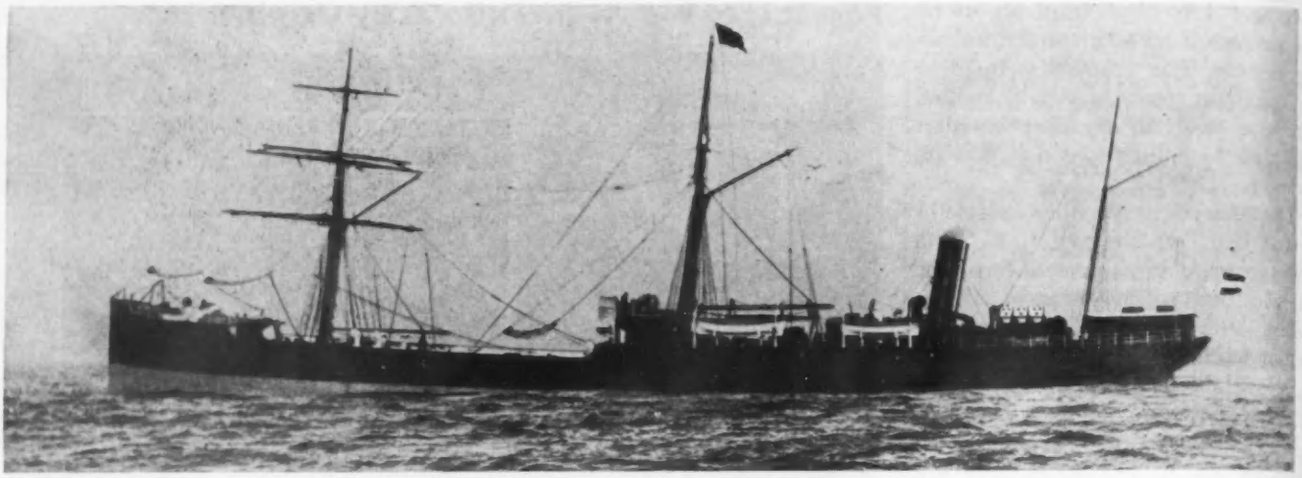
Forecast of World Oil Exports by Origin . . .



A Forecast of Main Oil Movements by Sea . . .







Tankers of yesteryear are a far cry from the supertankers of today. The S.S. Gluckauf, first steam tanker owned by the Standard Oil Group and built in 1886 was 300 feet long, 37 feet wide, steam powered, and also fitted with sails.

creased. The amount of oil delivered per year per average ship is now some 70 percent greater than pre-war. The amount of steel per ton deadweight drops with increase in size—a law applicable to almost all plant and equipment in the industry. The manpower needed to run the ship does not increase in proportion to size. So an economy in both steel and manpower per unit of oil delivered has been achieved by building bigger and faster vessels.

The use of large tankers in oil trade has been possible mainly as a result of the development of refineries in consuming countries as growing local demand justified large scale units. In some cases the saving that can be achieved in carrying crude oil in large batches as far as possible on the journey instead of products in small parcels all the way has played a part in the location of refineries in consuming countries. Today some 60 percent of all main exports are in the form of crude oil, compared with 27 percent in 1938.

At the end of 1955 there were 250 tankers of 24,000 tons d.w. or over and a further 290 on order, including five of over 50,000 tons d.w., two of which will be 83,000 tons d.w. These very large ships are being designed to carry ore or other bulk cargoes on part of what would normally be the ballast run back to oil loading ports.

Harbors and Channels Limit Tanker Size. The practical limits to tanker size are set by facilities at loading and discharging ports, approach channels, river passages and to some extent by the Suez Canal. Facilities for maintenance, repair and dry docking are other factors that can affect the decision to build very large ships. It would seem that, taking all these factors into account, the standard size for large ships will probably be in the 30-40,000 ton class. On the other hand, there are a number of routes on which any size of ship can be used. Since the economies of size are most compelling, the prospects are that the operators in the industry will develop ports that can take the biggest of ships. They may even find it cheaper to carry oil for the greater part of the journey in the very largest possible tankers, completing the delivery to the refinery in smaller ships or pipe line.

It must not be forgotten in looking at the prospects for bigger and faster tankers that a great deal of work will remain to be done by their smaller sisters. The long hauls of crude will surely be entrusted to the biggest possible ships. But the delivery of products to the two thousand-odd ports capable of receiving ocean going tankers will be made in small ships. This will be because of limitations not only of port size but also of tankage at and offtake from receiving installations.

Pipe Line vs. Tanker. Future use and construction of tankers probably will not be materially retarded by substitution of pipe lines for tankers in major oil movements. For any given distance the unit cost of moving oil by tanker is cheaper than by pipe line. Only where a large pipe line can achieve maximum throughput and can cut a long sea voyage does it become competitive with tanker transport. The only major supply route at present where a pipe line can successfully replace tankers is in avoiding the long sea voyage from the Persian Gulf to the Mediterranean.

On simple economics the pipe line route from the Persian Gulf to the Mediterranean is the cheapest. This is because the capital cost would be less than the cost of tankers to carry the oil around Arabia to Port Said. Provided reasonable terms can be obtained for pipe line wayleaves, the operating cost is also likely to be cheaper. The decision as to whether the oil companies will choose the pipe line route or will rely on tankers will not rest entirely on economics, however, and cannot be forecast.

Pipe lines would be possible from the Middle East across Europe. But even if the distance saved made a line more economical than the sea voyage, it is doubtful if the risk involved in the investment in such a fixed asset

About the Author

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through so many countries ever will be taken.

After the war the quantities of crude oil moving westwards from the Persian Gulf became great enough to justify the laying down of large diameter lines which could be fully used. One such line, the Trans Arabian Pipe Line, was built. Others were planned. But concessionary difficulties caused them to be shelved.

Shipping Around Africa. If tankers have to be routed around the Cape of Good Hope, the cost may not be as high as the alternative distances suggested, provided adequate sized tankers can be used. The distance, for example from the Persian Gulf to northeast U. S. via the Cape is some 42 percent greater than via the Canal. But after taking into account the saving in canal dues, the differential between the two routes is narrowed to some 25-30 percent.

It might well be that the cost ratio of routing the very largest and fastest tankers fully loaded via the Cape instead of partially loaded, because of draft restrictions, through the Canal, would reduce even further the economic disadvantage of the Cape route. Indeed, theoretically, a point might be reached with a big enough and fast enough ship where the Cape voyage proved no dearer than via the Canal.

Any major use of the Cape route at reasonable costs assumes, however, that there will be ship building and repairing facilities for a large number of the biggest possible ships, and that suitable ports can be found to take them. These are assumptions not surely beyond the capabilities of the engineers of today.

Smaller ships might be able to go via the Cape at costs comparable with the Suez Canal route if speeds could be increased. With conventional power plants, however, the cost of bunker fuel outweighs the advantage of the speed that would be necessary. It is at this point, perhaps, that we turn to atomic energy. Might it be possible, in the next 20 years, to consider building moderately large but really fast ships on nuclear power, saving valuable quantities of steel for tanker construction and of fuel oil for bunkers? There is perhaps some precedent for this in that today most coal exports are carried in ships burning oil.

—**The End**

4% Increase in Demand Is Forecast for 1957

- **Total domestic and export requirements expected to average 9,598,000 barrels daily, an increase of 371,000 barrels or 4.0 percent over 1956.**
- **Domestic consumption in 1957 will average 9,265,000 barrels a day, up 366,000 barrels or 4.1 percent.**
- **Exports will average 333,000 barrels daily, about the same as in 1956.**
- **Crude oil production in the U. S. will need to average 7,309,000 barrels daily in 1957, an increase of 2.6 percent, it is indicated.**
- **Crude runs to stills will approximate 8,221,000 barrels daily, up 3.2 percent from 1956.**
- **In the five years, 1957-1962, total demand for oil is expected to increase 3 percent annually.**

By E. T. KNIGHT
The Atlantic Refining Company
Philadelphia

TOTAL DEMAND for petroleum products in 1957 should be at least 4 percent greater than in 1956. And in the five years from 1957 to 1962, demand is expected to increase at an annual average rate of 3 percent.

Forecast for 1957. Total requirements for petroleum and products in 1957 will approximate 9,598,000 barrels daily. That level of demand would be 371,000 barrels daily or 4.0 percent more than the 1956 demand

(seven months actual and five months estimated).

It is forecast that domestic demand in 1957 will average 9,265,000 barrels a day, an increase over 1956 of 366,000 barrels a day or 4.1 percent.

Exports of crude and products are expected to average 333,000 barrels a day in 1957, approximately the same as in 1956. This latter forecast could be significantly changed by developments in the Suez Canal dispute.

This forecast accepts the current concensus that there will be no spectacular change in general business in 1957 and that it will compare reasonably well with 1956. It is the expectation of Atlantic's own department that the Federal Reserve Board Index will average slightly higher in 1957 than in 1956. This forecast also considers the trends in demand for petroleum products in recent periods.

Gasoline. As shown in Table 1, the domestic demand for gasoline is expected to average 3,967,000 barrels daily in 1957. That level of consumption would be 163,000 barrels a day or 4.3 percent greater than the 1956 consumption.

The expected gasoline consumption by categories of consumers is shown in Table 2. The indicated trend in consumption of gasoline by trucks and busses results from expectation that during 1957 the average number of these units in operation will increase 3.0 percent, while trucks and busses consuming other motor fuels will increase approximately 10 percent.

Kerosine. An estimated level of demand for kerosine of 325,000 barrels daily would be 1.7 percent below the 1956 consumption. It was considered that the weather next year would be normal and the heating portion of this category of demand would be somewhat lower than in 1956. Colder than normal weather was experienced during the last 12 months.

Distillate Fuels. The forecasted demand for distillate fuels by categories is shown in Table 3.

Demand for diesel fuels in 1957 is expected to average 513,000 barrels daily, an increase over 1956 of 22,000 barrels, or 4.5 percent. The higher than average increase in consumption of diesel fuels by trucks and busses results from the previously predicted increase in average number in use of 10 percent.

TABLE 1
Demand for Petroleum Products

PRODUCT	1956 Quantity 1,000 B/D	1956 Percent Increase Over 1955	1957 Quantity	1957 Percent Increase Over 1956
Domestic Demand				
Motor Fuel	3,804	5.0	3,967	4.3
Kerosine	331	3.3	325	—1.7
Distillate Fuels	1,734	8.9	1,803	3.9
Residual Fuels	1,555	1.8	1,575	1.3
Liquefied Petroleum Gas	443	13.3	482	8.7
Other	1,032	7.0	1,113	8.8
Total Domestic	8,899	5.8	9,265	4.1
Exports				
Crude Oil	29	—9.2	30	3.5
Products	299	—10.8	303	0.8
Total Exports	328	—10.0	333	1.3
Total Demand	9,227	5.1	9,598	4.0

TABLE 2
Domestic Demand for Gasoline, 1957

Class of Consumer	Quantity 1,000 B/D	INCREASE OVER 1956 Quantity 1,000 B/D	INCREASE OVER 1956 Percent
Passenger Cars	2,443	113	4.8
Trucks	779	23	3.0
Busses	31	....	....
Total Automotive	3,253	136	4.4
Aviation	212	11	5.5
Industrial Naphtha	69	2	3.0
Other (Inc Gov't M.F.)	433	14	3.3
Total	3,967	163	4.3

TABLE 3
Domestic Demand for Distillate Fuels, 1957

PRODUCT	Quantity 1,000 B/D	INCREASE OVER 1956 Quantity 1,000 B/D	INCREASE OVER 1956 Percent
Diesel Fuels			
Railroads	238	7	3.0
Trucks and Busses	80	7	8.8
Miscellaneous	195	8	4.1
Total Diesel	513	22	4.5
Other Distillates			
Heating Oils	1,075	33	3.1
Miscellaneous	215	14	7.0
Total Other	1,290	47	3.8
Total Distillates	1,803	69	3.9

TABLE 4
Domestic Demand for All Other Products by Categories

PRODUCT	1956 Quantity 1,000 B/D	1956 Percent Increase Over 1955	1957 Quantity 1,000 B/D	1957 Percent Increase Over 1956
Lubricants	121	3.8	122	0.8
Wax	12	4.0	12	....
Jet Fuel	186	20.8	218	17.0
Asphalt	242	4.5	271	11.7
Road Oil	24	6.1	26	8.0
Still Gas, Misc. and Losses	447	4.4	464	3.8
Total	1,032	7.0	1,113	8.8

The forecast of a modest increase in use of distillate heating oils reflects the fact that colder than normal weather during 1956 resulted in average heating oil requirements per unit somewhat higher than can be expected in 1957. However, it is expected that the average number of units in operation during the coming year will be 5 percent greater than in 1956 and consumption of distillate fuels will be 3.1 percent greater.

Residual Fuel. The domestic requirements for residual fuel are expected to average 1,575,000 barrels a day during 1957, an increase of 1.3 percent. Although industrial production may increase two or three percent over 1956, competition may result in some consumers switching to the use of competing fuels. Heating requirements are not expected to be any higher in 1957. They may even be somewhat less, assuming normal weather.

Liquefied Petroleum Gas. Demand for liquefied petroleum gas is expected to increase about 8.7 percent to a daily average of 482,000 barrels in 1957. In projecting the level of demand for 1957, it was considered that the requirements of the chemical industry and the direct use of this product as motor fuel would be relatively greater than other segments of consumption, which are expected to increase about 7.0 percent.

All Other Products. Total domestic demand for all other products is forecasted to be 1,113,000 barrels daily for 1957, an increase of 81,000 barrels a day or 8.8 percent over 1956.

The forecast of a modest increase in demand for lubricants reflects thinking that the ratio of motor oil consumption to gasoline consumption will continue to decrease and that industry will continue to make further advances in the efficient use of industrial oils.

The forecast for jet fuels is based upon appraisal of the significance of government requests for bids on these products.

The impetus of the Federal highway program is expected to result in a demand for asphalt 11.7 percent above the indicated 1956 domestic consumption.

Data by Quarters. For those who are interested in the seasonal requirements of the foregoing over-all forecast, Table 5 has been prepared. From these data it is indicated that demand in the last six months of 1957 will be approximately 5 percent greater than estimated for the closing six months of 1956. The relatively lower seasonal trend in increased requirements during the first six months of 1957 results in part from the fact that demand for specific products was relatively higher in the first six months of 1956 as a result of unusually cold weather.

Problems. So much for expected demands. To complete this forecast and provide a look ahead on the expected supplies of petroleum and products, the answer to a number of controversial problems would be required. Chief among these problems are:

- The future operations of the Suez Canal.
- The trend of stocks of crude oil and petroleum products.
- The expected volume of imports.

No attempt has been made to forecast the solution to these problems. But for the purpose of completing the story, the following assumptions have been made:

- **First:** Although the Suez Canal controversy may extend into the early months of 1957, there will be no marked change in the pattern of world movements of crude and petroleum products.
- **Second:** The combined increase in stocks of crude oil and petroleum products will average 35,000 barrels a day in 1957, as compared to 126,000 barrels a day in 1956. The competitive nature of the industry, the increased number in the grades of products marketed, and the need for efficient operation have resulted in relatively high stock levels. These trends probably will continue to operate during the near-term future to increase the level of stocks but not to the extent recorded during recent months.
- **Third:** Imports of crude oil employed in this presentation are the average rates for November and December, 1956 and January, 1957, of crude oil imports shown in the schedule of the Texas Railroad Commission release of Sept. 24, 1956.

These assumptions are not forecasts or recommendations. They are

TABLE 5

Forecast of Demand for Petroleum Products in 1957, by Quarters
(THOUSANDS OF BARRELS DAILY)

PRODUCT	FIRST QUARTER		SECOND QUARTER		THIRD QUARTER		FOURTH QUARTER	
	Quantity	Percent Increase Over 1956	Quantity	Percent Increase Over 1956	Quantity	Percent Increase Over 1956	Quantity	Percent Increase Over 1956
Domestic Demand								
Motor Fuel	3,564	4.0	4,166	4.0	4,181	4.5	3,950	4.5
Kerosine	466	—2.3	185	—3.6	200	....	450	—0.7
Distillate Fuels	2,510	4.5	1,290	—0.8	1,210	4.3	2,210	6.4
Residual Fuels	1,835	0.2	1,425	—0.1	1,340	4.3	1,705	1.5
Liquefied Petroleum Gas	542	8.8	407	10.0	420	6.3	60	9.8
Other	908	9.4	1,153	6.3	1,321	7.4	1,066	8.8
Total Domestic	9,825	3.8	8,626	2.9	8,671	4.8	9,941	4.9
Exports								
Crude Oil	28	—3.8	30	....	30	6.2	30	6.2
Products	277	3.0	317	—2.8	315	....	303	1.0
Total Exports	305	2.3	347	....	345	0.6	333	1.5
Total Demand	10,130	3.8	8,973	2.8	9,016	4.7	10,274	4.8

TABLE 7

Forecast of Supply and Demand for Petroleum in 1957, by Quarters
(THOUSANDS OF BARRELS DAILY)

ITEM	FIRST QUARTER		SECOND QUARTER		THIRD QUARTER		FOURTH QUARTER	
	Quantity	Percent Increase Over 1956	Quantity	Percent Increase Over 1956	Quantity	Percent Increase Over 1956	Quantity	Percent Increase Over 1956
Demand								
Total Demand	10,130	3.8	8,973	2.8	9,017	4.7	10,275	4.8
Stock Change	—405	....	+500	....	+550	....	—510	....
Required Supply All Oils	9,725	1.7	9,473	2.4	9,567	3.4	9,765	3.2
Sources of Supplies								
Natural Gasoline, LPG, Benzol	845	5.1	810	6.0	800	8.3	865	4.5
Imports of Products	560	....	440	—6.2	390	0.0	510	....
Required Supply of Crude Oil	8,320	2.8	8,223	2.6	8,377	3.3	8,390	3.3
Imports of Crude Oil	1,018	18.0	1,018	11.4	1,018	2.9	1,018	—2.3
Production of Crude Oil	7,302	1.0	7,205	1.4	7,359	3.9	7,372	5.2
Crude Run to Stills	8,245	3.1	8,063	3.1	8,359	3.9	8,320	3.7

TABLE 6

Supply and Demand for Petroleum

ITEM	1956		1957	
	Quantity 1,000 B/D	Percent Increase Over 1955	Quantity 1,000 B/D	Percent Increase Over 1956
Demand				
Total Demand	9,227	5.1	9,598	4.0
Stock Change	+126	...	+ 35	...
Required Supply, All Oils	9,353	6.5	9,633	3.0
Sources of Supplies				
Nat. Gaso., LPG, Benzol	786	8.5	830	5.6
Imports of Products	483	3.6	475	—1.8
Required Supply Crude Oil	8,084	6.5	8,327	3.0
Imports Crude Oil	957	22.4	1,018	6.4
Production Crude Oil	7,127	4.6	7,309	2.6
Crude Oil Runs to Stills	7,965	6.5	8,221	3.2

TABLE 8

Long Term Forecast of Demand for Petroleum Products
(THOUSANDS OF BARRELS DAILY)

PRODUCT	1957 Forecast	1962 Forecast	Percent Increase 1957-1962
Domestic Demand			
Motor Fuel	3,967	4,687	18.0
Kerosine	325	330	1.5
Distillate Fuels	1,803	2,225	23.4
Residual Fuels	1,575	1,625	3.2
Liquefied Petroleum Gas	482	700	45.0
Other	1,113	1,533	25.0
Total Domestic	9,265	11,100	20.0
Exports			
Crude Oil	30	25	—16.6
Products	304	225	—26.0
Total Exports	333	250	—25.0
Total Demand	9,598	11,350	18.3

TABLE 9

Long Term Forecast of Domestic Demand for All Other Products
(THOUSANDS OF BARRELS DAILY)

PRODUCT	1957 Forecast	1962 Forecast	Percent Increase 1957-1962
Lubricants	122	143	17.2
Wax	12	14	14.2
Jet Fuel	218	450	106.4
Asphalt	271	350	29.2
Road Oil	26	35	34.6
Still Gas, Misc., and Losses	464	541	16.6
Total	1,113	1,533	37.7

merely working hypotheses necessary to show a complete supply-demand picture.

Crude Production. Based on these assumptions and the forecast of demand, crude oil production would average 7,309,000 barrels daily, an increase of 2.6 percent over 1956.

Runs to Stills. Runs to stills required to supply the projected demand will approximate 8,221,000 barrels daily, or 3.2 percent more than the estimated 1956 runs to stills.

There do not appear to be any immediate problems before the industry that cannot be solved readily. Any marked deviation of the proportions of products consumed from the pattern forecast can be met by adjustments in yields of products from crude processed.

The seasonal trend in supplies of petroleum and products is presented in Table 7.

Five Year Forecast. It is desirable, when planning for the future, to have some indication of the demand likely to be experienced in the more distant future. For that reason, a forecast of 1962 demand has been prepared, based on trends as seen today.

In preparing this forecast some factors which will affect favorably the demand for petroleum were considered. They are:

- Increased leisure time of passenger car owners.
- Growth in number of two-car families as the switch to suburban living continues.

About the Author

EDWARD T. KNIGHT is a petroleum economist for The Atlantic Refining Company, Philadelphia. He became associated with Atlantic in 1920. He is a graduate of Langhorne High School and Philadelphia Business College, and studied statistics and economics at Wharton School, University of Pennsylvania.

- Improvement in highways between distant points.

There is also one major factor which will be operative in the more distant future. But its effects on demand cannot be appraised at this time. That is new types of engines, gas turbines and free piston engines, which are now in the development stage.

It is estimated that by 1962 domestic demand will approximate 11,110,000 barrels a day, an increase of 20.0 percent over the forecast for 1957. Domestic demand for motor fuel should be at least 18.0 percent higher and distillate fuels 23.4 percent above 1957 forecasts. Exports of crude and products will probably decline about 25 percent, dropping to about 250,000 barrels a day.

The combined total demand in 1962 of 11,350,000 barrels a day is an increase over 1957 of 18.3 percent.

The level of demand estimated for both the near and long term future is influenced by the results of previous forecasts. The 1956 experience indicates that conservativeness was an important factor in forecasting, and the forecasts should have been more optimistic. The forecasts presented for 1962 may also be too conservative. The indicated trends should be considered as more important than the absolute volumetric levels that have been presented.

ACKNOWLEDGMENT

Presented originally to a session on petroleum statistics during the annual meeting of the American Petroleum Institute in Chicago, Nov. 14, 1956.

More about Pierce Junction . . .

November 14, 1956

Mr. Paul Peebles
c/o World Oil
P. O. Box 2608
Houston 1, Texas

Dear Paul:

I see by the paper that the Prominent Geologist, Sidney Strong, of Fort Worth, Texas, has disturbed your peaceful retirement by barking. Well, Paul, I don't know what he is barking so loud about, but since he is a Prominent Geologist I am sure he is right. "Geologists are always right" and to help him out you will find the article to which he refers on pages 95, 96, 97 and 98 of your paper dated September 2, 1927.

Now, Paul, let's be honest about it—that article about Pierce Junction was right and had there been any oil wells drilled to 8000 feet located one mile to the east and west and to the north and south—Wayne Bowman would have known about them, too.

Yours truly
Honest John

(Editor's Note: Earlier correspondence on this subject appeared in WORLD OIL of September, 1956, Page 128, and November, 1956, Page 204.)

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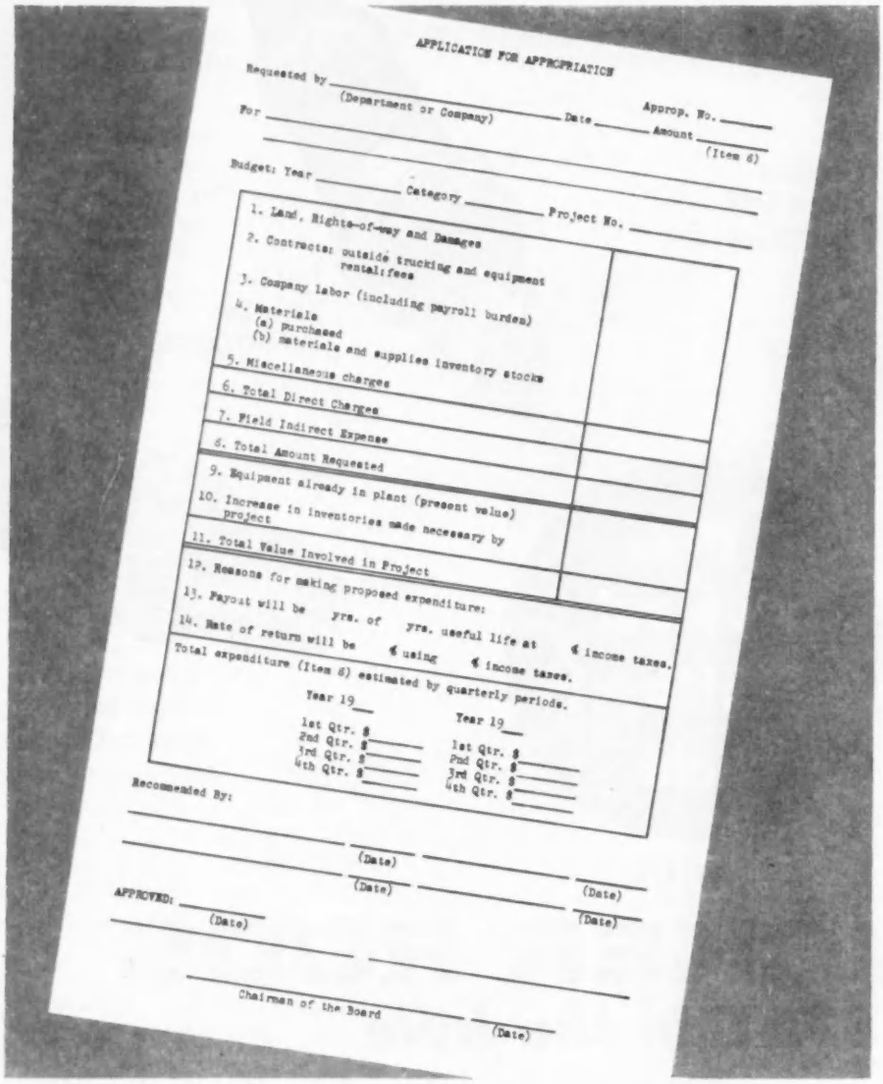

APPLICATION FOR APPROPRIATION

Requested by _____ (Department or Company) Date _____ Approp. No. _____

For _____ Amount _____ (Item 6)

Budget: Year _____ Category _____ Project No. _____

1. Land, Rights-of-way and Damages
2. Contractor outside trucking and equipment rental; fees
3. Company labor (including payroll burden)
4. Materials
   (a) purchased
   (b) materials and supplies inventory stocks
5. Miscellaneous charges
6. Total Direct Charges
7. Field Indirect Expense
8. Total Amount Requested
9. Equipment already in plant (present value)
10. Increase in inventories made necessary by project
11. Total Value Involved in Project
12. Reasons for making proposed expenditure:
13. Payout will be _____ yrs. of _____ yrs. useful life at _____ % income taxes.
14. Rate of return will be _____ % using _____ % income taxes.

Total expenditure (Item 6) estimated by quarterly periods.

Year 19__ | Year 19__
1st Qtr. $ | 1st Qtr. $
2nd Qtr. $ | 2nd Qtr. $
3rd Qtr. $ | 3rd Qtr. $
4th Qtr. $ | 4th Qtr. $

Recommended By: _____ (Date)

_____ (Date)

_____ (Date)

APPROVED: _____ (Date)

_____

Chairman of the Board _____ (Date)

FIGURE 1—Sample form used by one of the surveyed companies to request authority for appropriations.

EXCLUSIVE REPORT

How 15 Companies Handle Capital Expenditures

- 14 out of 15 companies prepare budgets.
- Only 3 companies plan more than one year ahead.
- One firm requires a post-audit on all completed projects.

By G. E. KISER, Chairman
Department of Economics and Business Administration
Texas Western College,
El Paso, Texas

SUCCESSFUL COMPLETION of a project—whether it be an exploration program, development and equipping of a lease or a water-flood operation—depends on the way two vital questions are answered.

1. Are the *plans* for capital expenditures sound?

2. Are the *controls* properly designed to administer the plan?

The following is a survey report on the way 15 oil companies plan and control capital expenditures. Property, plant and equipment spending for the selected group of companies total over $1 billion, or one-fourth of the oil industry's total expenditures in the U. S. (see Table 1). Here are the results of the survey.

Planning Capital Expenditures

Five major aspects enter into plan-

TABLE 1
Gross Capital Expenditures of 15 Oil Companies That Were Surveyed

Company	(Million of Dollars) 1950	1951	1952	1953	Total
A	$ 86.7	$ 145.7	$ 206.1	$ 237.7	676.2
B	118.0	164.5	172.2	213.5	668.2
C	131.1	158.8	203.4	206.3	699.6
D	160.8	143.5	173.1	173.8	651.2
E	110.5	158.8	160.3	154.2	583.8
F	43.7	88.7	90.7	89.8	312.9
G	120.7	133.5	94.0	47.6	395.8
H	35.0	113.5	96.8	45.2	290.5
I	38.8	71.3	72.9	82.1	265.1
J	25.6	32.6	40.5	48.3	147.0
K	4.2	7.4	12.1	12.2	35.9
L	.9	1.0	1.5	1.7	5.1
M	.....	.....	.....	.....	.....
N	.....	.....	.....	.....	.....
O	.....	.....	.....	.....	.....
Total	876.0	1219.3	1323.6	1312.4	4731.3

(Information was not available on last three companies. They are relatively small companies with majority of the stock being held by one family.)

ning capital equipment expenditures:

1. **Capital Budget**—Fourteen of the 15 oil companies surveyed construct a capital budget as the basic instrument of planning.

A capital budget covers the probable capital expenditures for the coming budget period, consolidated in such a way as to present the aggregate demand for capital funds and expressed in terms of specific individual assets which have moved up through the management hierarchy for supervisory review. This is an intellectual process, the conscious determination of a course of action based on purpose, facts, and considered estimates.

Two different systems are used in preparing the capital budget:

1. Top management compiles the information supplied from the "grass roots" of the company. Wide participation by employes at all levels in the organization is emphasized. The person closest to the daily operational needs of the enterprise is assumed to be aware of those expenditures that will make his individual efforts most rewarding. Each proposal is screened and translated into an estimate of over-all capital needs. Twelve of the 15 respondents use this system.

2. In two companies top management states in general terms the capital spending authorized in each operating area of the company. This pronouncement of policy is issued annually and is the result of the best economic forecast available. It is transmitted from the top administrative level and is used as a guide for the lower echelons of management during the coming year.

2. The Planning Period—The length of the planning period ranges from 1 to 5 years, but only three companies report that they make capital planning programs for longer than 1 year. Even then, however, the long-range forecasts are revised annually, for at best they represent only rough estimates.

The consensus is that the value of a detailed long-term budget does not merit the time and trouble that must be put into it. Nevertheless, there is growing belief that a sensible budget cannot be based on one-year forecasts alone since many capital projects may require several years to construct before operations begin.

WELL COSTS

Month _____ Year _____

Field _____ Property _____ Well No. ___

Appropriation No. ___ Drill ___ Redrill ___ Deepen ___

TANGIBLE	APPROPRIATED	EXPENDED
Gas Traps		
Pipe & Electric Lines		
Producing Equipment		
Tankage		
Well Pipe		
Miscellaneous		
Total Tangible		
INTANGIBLE		
Cementing		
Contract Drilling		
Contract Services		
Drilling Fluids		
Roads and Location		
Supplies		
Miscellaneous		
Field Indirect Expense (District Expense)		
Plant Loss		
Total Field Intangible		
Total Field Cost		
OVER OR (UNDER) EXPENDED		

FIGURE 2—Another important phase of expenditure planning is the Cost Accumulation form above used by one surveyed company to keep a permanent record of well costs for future comparisons.

3. Flexibility—Flexibility is incorporated into the plan to compensate for changing conditions. A high degree of flexibility seems to characterize the smaller companies, whereas more rigid controls are inherent in the budgets of larger firms.

Tight control over revisions has at least one advantage in that it tends to make for better planning when executives know that there is little opportunity for them to correct planning errors. Conversely it may pose a limitation on new schemes which are of value to the company.

4. Criteria For Discrimination—Desired expenditures almost always exceed the practical limits of available means. Consequently, methods are devised for selecting desirable projects and for eliminating those which do not contribute their proportionate share toward attaining the over-all objective.

In the selection process individual proposals are scrutinized and compared with other budget candidates on the basis of:

- The length of the payout period.
- The rate of return that is expected from the investment.
- The degree of necessity attached to each.

Pay-out. The reporting companies universally use years-to-pay-out to distinguish between "good" and "bad" investment proposals. This method is based on the number of years expected to elapse before the gross earnings of a new project return the original investment. When the project will pay for itself within two, three, or four years, it assumes a high degree

of attractiveness. When pay-out is projected beyond that time, it becomes progressively less attractive as the period increases.

Return on Investment. Two methods are used to calculate return on investment:

1. Compute a ratio of average anticipated earnings, after taxes and depreciation, to some measure of investment, either original outlay or average book value. (Twelve of the 15 firms consider this just another way of stating payout.)

2. Compute the return on the investment actually outstanding from time to time over the life of the venture—the financial method. Three reporting firms use this technique.

Necessity. Many projects if judged strictly from their profit potential would never be undertaken. But because of government decree, breakdowns in strategic operational phases, etc., certain investments become mandatory and must be put at the top of the priority list regardless of financial expediency.

5. Replacement—When the spending decision involves replacement (not simply an addition to plant capacity) all of the reporting companies resort to rule-of-thumb methods seasoned with experience. Comparisons of operating costs with a standard rate give replacement signals in some cases. Other firms replace automatically after a designated period of time has elapsed.

6. A Recommended Planning Method—Theoretically, not all of the companies responding to the survey have as effective a procedure for planning capital spending as they might have. One company is in the process of changing its procedures to make planning more accurate.

In theory the minimum requisites of a successful capital planning program are:

► Devise a sound budgeting procedure in which adequate attention is given to soliciting investment proposals from the "grass roots" of the company compatible with a high degree of centralized planning and control.

► Determine a minimum acceptable rate of return on each general grouping of facilities—production, refining, transportation and marketing commensurate with the risk inherent therein. One respondent computes its average, long-run cost of capital at about 7 percent after taxes. But in order to expand and obtain a satisfactory return when risks are high, the company expects a return of 10 percent or better on pipe line facilities, 14 percent or better on refining facilities, and 18 percent or better on development wells and petrochemical investments.

► Select a single, meaningful yardstick which may be used to discriminate between proposals involving purchases of new equipment. The financial method of calculating return on investment is recommended. The rate, thus determined, may be compared with the minimum acceptable rate to give a definite clue as to the course of action to be followed (see Table 2).

TABLE 2

Appraisal of New Capital Investments

Comparison of Methods: Investments with Increasing Income

ASSUMPTIONS:

Original Investment		$ 56,502
Annual Income, After Taxes Before Depreciation	(1st to 3rd yrs.)	6,000
	(4th to 7th yrs.)	10,000
	(8th to 10th yrs.)	14,000
Life of Investment		10 years
Total Income		$ 100,000
Total Profit After Return of Original Investment		43,498

1. Return Based on Original Investment:

Average Annual Income, After Taxes Before Depreciation		10,000
Deduct: Depreciation (56,502 + 10 years)		5,650
Annual Income After Taxes and Depreciation		$ 4,350
Return on Investment $\frac{\$\ 4,350}{\$56,502}$ =		7.7%

2. Return Based on Average Investment:

Average Annual Income, After Taxes Before Depreciation		$ 10,000
Deduct: Depreciation $56,502 + 10 years)		5,650
Annual Income After Taxes and Depreciation		$ 4,350
Return on Investment $\frac{\$\ 4,350}{\$28,251}$ =		15.4%

3. Return Calculated by Financial Method:

YEARS	Income	Discount Factor—10%	Present Value
1st to 3rd	$ 6,000	2.4869	$14,921
4th to 7th	10,000	2.3816	23,816
8th to 10th	14,000	1.2761	17,866
	(Equals Investment)		$56,603

Verification of 10+% Return:

Year	Income	Interest @ 10%	Return of Principal	Balance of Principal at Beginning of Year
1st	$ 6,000	$ 5,650	$ 350	56,502
2nd	6,000	5,615	385	56,152
3rd	6,000	5,578	422	55,767
4th	10,000	5,535	4,465	55,345
5th	10,000	5,088	4,912	50,880
6th	10,000	4,597	5,403	45,968
7th	10,000	4,057	5,943	40,565
8th	14,000	3,462	10,538	34,622
9th	14,000	2,408	11,592	24,084
10th	14,000	1,249	12,751	12,492
	$100,000	$43,239	$56,761	— 259*

* Does not come to zero because of rounding of numbers

► Consider the Machinery and Allied Products Institute's Replacement Formula as a technique for replacement planning to be used in conjunction with current cost accounting procedures. This formula eliminates guesswork in replacement decisions. It is succesfully used in many other industries.

► Establish a definite policy and an economical procedure which will provide sufficient post-audit information on completed projects to enable management to compare initial predictions with actual results.

Controlling Capital Expenditures

If controls over capital expenditures are designed and administered so as to bear out sound planning principles, the building of the project as well as its ultimate usefulness is assured insofar as knowledge of the future can accurately be predicted. The control schemes found to exist in the companies included in this survey are designed to evaluate the conformity of planned activity and actual results.

Although all of the reporting companies do not have a highly formalized control system, there are two major factors which are typical: Controls related to starting and completing the project—and controls related to the contribution of the project to company operations.

Controls Related to Starting and Completing the Project

These practices fall into the following six major subdivisions:

1. *Inclusion in the Budget.* Fourteen of the 15 companies use a plant and equipment budget. This practice not only assures that capital needs of the firm will be balanced against its capital resources, but that prospective commitments will be examined with a view to determining their conformity to long-range plans. Each proposal must meet certain standards of quality before it is included in the budget. Thus the control, as well as the plan, starts with the budget.

2. *Authority for Expenditure (AFE).* The mere fact that a capital item is approved by the budget committee and incorporated in the budget does not mean that the way is cleared to commit the funds. All of the surveyed companies use an additional procedure, the AFE, a form which

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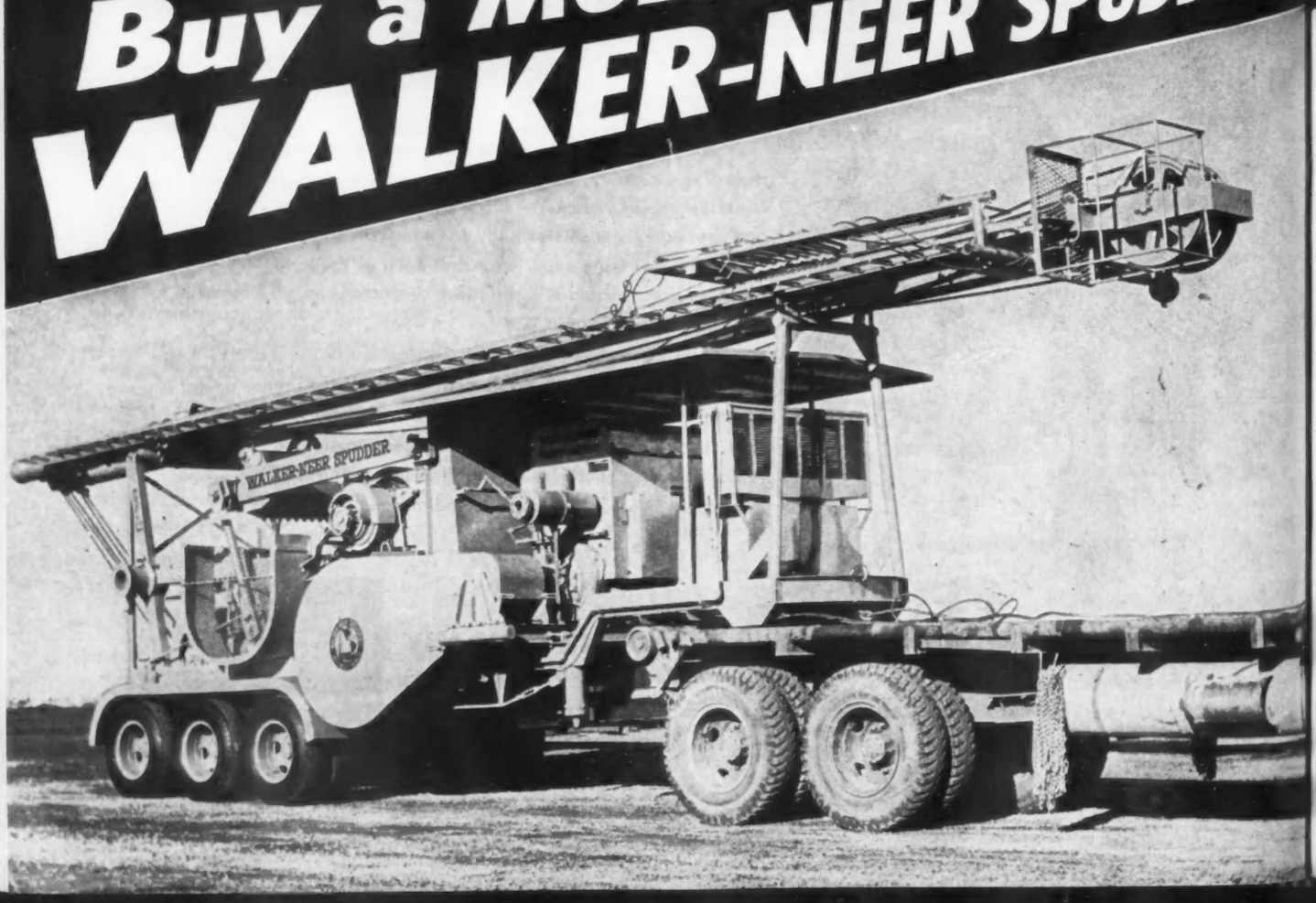

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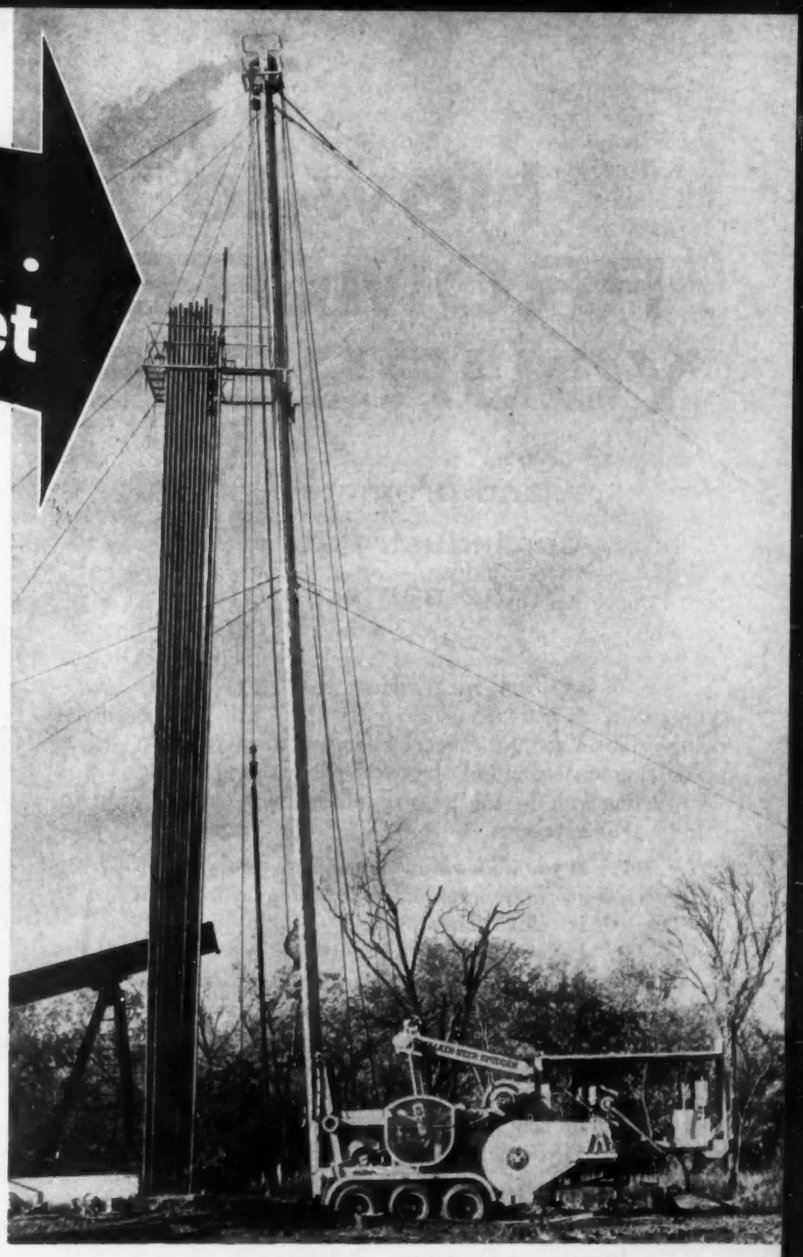
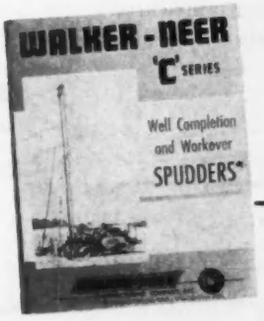


C-37 Spudder owned by J. F. Stephenson, Oil Producer, Ardmore, Oklahoma, equipped with triple-axle tandem and 82-foot mast with fingerboard, shown on 5800-foot frac job near Countyline, Oklahoma.



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requires the fund-using agency to obtain specific authorization to spend any of its allocations. This form permits top management to take a "second look" at the spending proposal in light of currently prevailing conditions.

The AFE is designed to present pertinent information about the expenditure in question. In addition, supporting details to justify the request for funds are always attached as a part of the AFE. On large projects the AFE file becomes quite voluminous. (See Figure 1, a representative form used by one company.)

Authority to approve an AFE is delegated to the operating executives. A wide variation exists among the surveyed companies as to the limits of authority assigned to each executive level. This dissimilarity depends not only upon the individuals in those positions but also upon the particular type of asset in question. Delegation is usually more liberal when the item is in the budget than when it is an addition to the budget.

3. *Cost Accumulation.* All of the companies accumulate cost data on authorized capital projects. Typically, all purchase invoices and work orders are routed through the accounting department where they are audited for necessary signatures and proper charges. (Figure 2 is a typical cost accumulation form.)

4. *Supplementary Requests.* The necessity for requesting additional funds arises when costs are not anticipated on the initial AFE, or when such costs are under-estimated. Ten of the reporting firms make automatic allowances for over-runs in the original allocation and do not require a supplementary AFE unless the excess is significant. Significant overruns range from a straight 10 percent of the project cost to a maximum of $10,000, or 10 percent, whichever is least.

5. *Progress Reports.* Periodic progress reports to the president, departmental executives, and other interested officials are used by all respondents. These summaries depict the status of all open appropriations and provide management with a buildup of charges against appropriations.

In addition to the status reports involving accounting facts, major executives make periodic visits to the construction site while the work is in progress and also at the time the work is completed.

6. *Completion Reports.* Completion reports signal the cessation of construction or installation activity. Invariably the notice will go to the accounting department and often to other major executives.

Controls Related to the Contribution of the Project to Company Operations

This type of control attempts to determine whether the original justification of the proposal is in accord with its actual performance. Only one firm reports that it requires a post audit on *all* completed projects, while one respondent has *no* means of appraising the contribution to over-all company operations.

The remainder of the surveyed companies subject a portion of their finished projects to review. For some projects a complete analysis would be too expensive and time-consuming; the profitability of others is obscured by the intricacy of accounting records.

The Most Accepted Method—The purpose of control of capital equipment spending is to recognize weaknesses and errors in the capital purchasing programs and to form a basis for forecasting the next period.

The control procedures of all surveyed companies that relate to starting and completing the project appear to achieve the purpose of control. But the procedures used to evaluate the contribution of the project to company operations seems inadequate. Too much post-audit control can be expensive while too little control does not throw enough light on the effectiveness of the capital spending program.

Among the surveyed companies, the firm which requires no post audit undoubtedly is not obtaining the maximum benefit from controls, while it may be costing too much for the other firm to audit all completed projects.

Perhaps the correct answer lies in one company's approach—to submit all projects costing over a certain dollar amount to regular review while lesser capital programs are analyzed on a random basis. This establishes a definite policy and an economical procedure which provides sufficient post-audit information for management to compare initial predictions with actual results. **—The End**

Oil Scarcity Talk Discounted

THE U. S. CURRENTLY has a comfortable reserve of oil producing ability. It could get along without any imports for at least several years. Whether this favorable situation can be maintained in the future will depend on national policies on imports. A reasonable volume of imports will effectively stimulate efficiency in domestic operations. But for reasons of national security, dependence on crude oil imports should be kept to a ratio not far from that of 1954.

This is the U. S. situation as regards oil producing ability, as seen by Dr. Richard J. Gonzalez, director and treasurer of Humble Oil & Refining Company, Houston. He explained these statements in a paper on "Petroleum for Our Future Progress." The paper was presented recently at the annual meeting of the American Petroleum Institute at Chicago.

"Domestic crude oil production could be sustained at a rate more than 2,000,000 barrels daily above recent levels for a period of three years or more, even with a substantial reduction in drilling if required by an emergency," Gonzalez stated. "This reserve productive capacity provides assurance that present requirements could be met from domestic sources alone.

"In case the industry is called upon to produce at maximum efficient rates, a decline in availability is to be expected only if drilling is stopped completely or curtailed very drastically, and then only gradually rather than abruptly."

Assuming continuance of drilling, an adequate reserve of producing ability will be assured well into the future, Gonzalez indicated. "Drilling at current or higher levels will mean continuation of the past upward trend in domestic petroleum availability for the foreseeable future."

He declared that "until such time as there is clear evidence that the domestic industry cannot find more than a barrel of new oil for every barrel produced, there is no reason to believe predictions that we will soon be running out of oil."

Nine Months Earnings Up 16.2% for 57 Companies

Oil industry shows gain while business in general maintains year-ago levels.

By L. J. LOGAN, WORLD OIL Staff

Net Earnings of Some Oil Companies in First 9 Months, 1956 and 1955
(Earnings per share are on basis of common shares outstanding September 30, 1956.)

COMPANY	1st 9 Months, 1956 Net Income	1st 9 Months, 1956 Per Share	1st 9 Months, 1955 Net Income	1st 9 Months, 1955 Per Share	% Diff. In 1956
Amerada Petroleum Corporation	$ 19,482,127	$3.09	$ 18,017,141	$2.86	+ 8.1
American Maracaibo Company	2,036,604	.61	1,634,795	.49	+ 24.6
Anderson-Prichard Oil Corporation	4,229,465	2.47	3,215,721	1.97	+ 31.5
Argo Oil Corporation	3,342,077	1.68	3,446,243	1.73	— 3.0
Arkansas Fuel Oil Corporation	5,746,119	1.51	5,731,198	1.51	+ 0.3
Atlantic Refining Company	32,691,242	3.53	24,367,884	2.61	+ 34.2
Aztec Oil & Gas Company	386,808	0.17	337,200	0.15	+ 14.7
Bishop Oil Company	307,748	0.56	273,849	0.50	+ 12.4
Buckeye Pipe Line Company	2,199,761	1.79	1,570,471	1.28	+ 40.0
Chicago Corporation	6,733,040	1.62	5,323,369	1.27	+ 26.5
Cities Service Company	43,491,760	4.30	34,300,449	3.46	+ 26.8
Clark Oil & Refining Corporation	2,021,346	1.77	1,176,661	1.03	+ 71.8
Colorado Oil & Gas Corporation	1,996,339	.52	942,312	0.18	+111.9
Continental Oil Company	39,142,000	4.01	34,455,000	3.53	+ 13.6
*Creole Petroleum Corporation	240,610,000	3.10	220,159,000	2.84	+ 9.3
Delhi-Taylor Oil Corporation	1,024,070	0.19	1,761,364	0.33	— 41.9
Getty Oil Company	6,274,359	1.02	3,383,417	0.52	+ 85.4
Gulf Oil Corporation	206,269,000	7.31	145,287,000	5.68	+ 42.0
Honolulu Oil Corporation	10,587,958	2.82	10,327,760	2.75	+ 2.5
*Imperial Oil, Ltd.	51,137,595	1.70	42,521,632	1.42	+ 20.3
*International Petroleum Company	28,700,000	1.98	24,600,000	1.69	+ 16.7
Louisiana Land & Exploration Company	10,486,073	1.17	10,393,480	1.16	+ 0.9
MacMillan Petroleum Corporation	153,380	0.15	115,195	0.11	+ 33.1
Maracaibo Oil Exploration Corporation	413,684	0.84	259,991	0.53	+ 59.1
Midwest Oil Corporation	5,003,652	1.96	4,502,167	1.76	+ 11.1
Mississippi River Fuel Corporation	5,563,552	1.59	4,813,343	1.42	+ 15.6
Oceanic Oil Company	248,833	....	142,166	....	+ 75.0
Ohio Oil Company	30,295,968	2.31	29,192,924	2.22	+ 3.8
Phillips Petroleum	71,570,432	2.08	65,189,370	1.90	+ 9.8
Plymouth Oil Company	5,984,320	2.47	5,210,404	2.16	+ 14.9
Pure Oil Company	26,210,000	3.06	24,650,000	2.82	+ 6.3
Quaker State Oil Refining Corporation	1,668,716	2.02	1,918,330	2.32	— 13.0
Richfield Oil Corporation	20,768,537	5.19	22,664,919	5.67	— 8.4
Seaboard Oil Company	7,530,091	2.06	6,104,496	1.67	+ 23.4
Shamrock Oil & Gas Company	6,630,774	2.88	5,538,191	2.45	+ 19.7
Shell Oil Company	100,143,561	3.64	85,646,413	3.11	+ 16.9
Signal Oil & Gas	7,045,711	1.80	6,506,880	1.74	+ 8.3
Sinclair Oil Corporation	66,032,449	4.51	56,137,940	3.84	+ 17.6
Skelly Oil Company	23,344,766	4.06	22,814,984	3.97	+ 2.3
Socony Mobil Oil Company	183,000,000	4.19	150,000,000	3.44	+ 22.0
Standard Oil Company of California	190,355,041	3.01	166,272,294	2.63	+ 14.5
Standard Oil Company of Indiana	114,990,949	3.36	102,783,318	3.00	+ 11.9
Standard Oil Company of Kentucky	9,561,000	3.67	9,546,000	3.66	+ 0.2
Standard Oil Company of New Jersey	603,000,000	3.07	523,000,000	2.66	+ 15.3
Standard Oil Company of Ohio	20,158,500	4.06	16,306,013	3.26	+ 23.6
Sun Oil Company	39,796,681	3.92	37,050,857	3.65	+ 7.4
Sunray Mid-Continent Oil Corporation	31,400,000	1.66	27,707,843	1.61	+ 13.3
Superior Oil Company of California	3,064,894	7.26	4,063,281	9.62	— 24.6
The Texas Company	207,429,255	3.78	189,767,006	3.46	+ 9.3
Texas Gulf Producing Company	4,426,331	1.20	4,718,297	1.29	— 6.2
Texas Pacific Coal & Oil Company	5,505,963	1.53	5,765,640	1.60	— 4.5
Tidewater Oil Company	30,091,000	2.31	27,256,000	2.07	+ 10.4
Union Oil Company of California	26,107,393	3.39	25,094,377	3.23	+ 4.0
Union Oil & Gas Corporation of Louisiana	2,176,122	1.20	1,349,786	0.74	+ 61.2
United Gas Corporation	21,824,106	1.69	19,515,285	1.51	+ 11.8
Universal Consolidated Oil Company	2,460,537	2.57	1,407,022	1.47	+ 74.9
Venezuelan Petroleum Company	6,950,211	1.73	3,349,905	0.83	+107.5
White Eagle Oil Company	741,705	0.49	257,534	0.17	+188.0
Wilcox Oil Company	689,558	2.42	672,727	2.36	+ 2.5
Woodley Petroleum Company	1,540,760	2.01	864,354	1.13	+ 78.3
* Total 57 Companies	2,282,326,328	....	1,964,100,566	....	+ 16.2

* Creole, Imperial Oil and International Petroleum are excluded from totals, being included as subsidiaries of Standard Oil Company (New Jersey).

FOR THE FIRST 9 MONTHS of this year, 57 oil companies reported an aggregate net income of $2,282,326,328, an increase of 16.2 percent over the $1,964,100,566 they earned in the first three quarters last year.

This was a better comparison than for business in general which has earned only about the same as last year. For business in general, profits were about 12 percent above last year in the first quarter, about the same as last year in the second quarter and about 10 percent below last year in the third quarter.

The petroleum industry earned more in each of the first three quarters of 1956 than in the corresponding periods of 1955. The oil companies showed earnings increases of about 20 percent in the first quarter of 1956, 15 percent in the second quarter and around 13 percent for the third quarter.

A continuance of relatively good earnings in the oil industry is indicated for the final quarter of 1956. If this indication is fulfilled, this year as a whole may bring an increase of around 15 percent in the oil industry earnings as compared with those of 1955.

Helping to hold petroleum profits above last year are the generally larger volumes of business. Sales of products and of crude oil are showing normal increases over last year.

The international oil companies will market less petroleum from the Middle East during the remainder of this year, and to a limited extent, their Eastern Hemisphere earnings will be reduced. However, those companies will be able to convert some of the Middle East losses into gains in business in the Caribbean area, the Far East and other areas since they can supply part of their Western European and other markets from the alternate sources.

For U. S. domestic companies, some increases in business are resulting from the trouble in the Middle East. Producers are gaining higher allowables in Texas, Louisiana, and elsewhere because of new export demand. Earnings of domestic companies consequently are being aided.

Also helping earnings are the moderate increases that have been made in prices of both heavy and light fuel oils and in prices of heavier crudes in California and elsewhere. —**The End**

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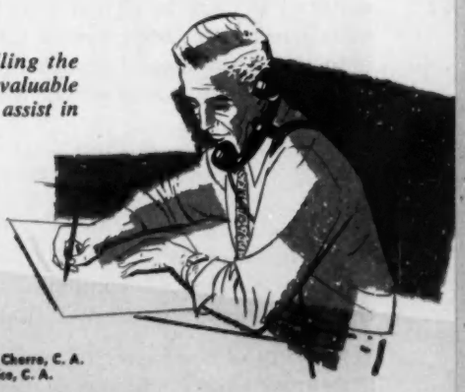

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If oil could speak it would have many fascinating truths to tell the non-oil public —truths that would win thousands of new friends for the oil industry.

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This article—the first in a series—is being presented for one purpose: To equip you with as many facts as possible about your industry, so you can tell the story that oil is unable to relate.

Read these facts. You will find them informative—and interesting.

EVERY OIL WORKER, from field man or secretary to chairman of the board has a stake in the public's attitude toward the oil industry.

If the attitude is bad, then the worker's chances of a better job in the future are bad. If the attitude is good, then his chances are good.

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The average John Q. Public, the voter, your friend who isn't in the oil industry, is daily being fed misrepresentations by somebody outside the oil industry. Occasionally somebody in the oil industry makes a bad bobble and the nation's press plays it to the hilt—with bad results to you and your job.

The truth is enough. If you can pass a few truths on to your friends who live next door, but are not in the oil industry, or whom you go to visit at night or who visit you—*that* is *your* part of a campaign for better understanding.

That is all any of us in the oil industry can expect—a better understanding—that is all *you* can do, help, among your friends, to create better understanding.

For instance there is the neighbor who thinks that oil men have a happy knack of going out and drilling a wildcat well—with consequent riches. *You* know better. There is the bridge (or poker) partner who thinks three or four large companies refine all the nation's oil. *You* know better.

How, specifically, can you help?

WORLD OIL has, with the help of reputable industry sources, compiled some pertinent *facts* you can pass on. Below you will find some of them. Future issues will contain more facts under the heading—"If Oil Could Speak."

Look for these facts—use them. Chances are you will find them very interesting to yourself—and we think your non-oil friends will be interested in hearing them from you.

Here are the facts: "If Oil Could Speak" it would tell the American public . . .

- One out of every 38 workers in the U. S. is employed in the oil industry. The million-plus oil employes are paid the second highest wages in the nation.
- Thirty of the larger oil companies have been forced to borrow over $5 billion in the past 20 years, despite assertions from various sources that the 27½ percent depletion provision is excessive.
- Eighty percent of all oil consumed in World War II came from U. S. wells!
- The average Texas oil well produces 20 barrels a day, compared with a national average of 14 barrels a day. The average well in the Persian Gulf produces 5000 barrels of oil a day.
- Within 25 years total demand for oil products has nearly tripled—from 3 million barrels a day to well over 8 million barrels a day. The oil industry has met this tremendous growth in demand—and to spare!
- Despite a tremendous consumption of over 41 billion barrels of oil since 1926, the known reserves are higher today than at any time in U. S. history.

REMEMBER: OIL CAN'T SPEAK—YOU CAN. ONLY YOU CAN GIVE NON-OIL PEOPLE THE TRUE FACTS ABOUT YOUR OIL INDUSTRY.

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Avondale Marine Ways grew up with offshore drilling. It was just a decade ago that oil companies began to expand on the marshlands of lower Louisiana . . . and to venture out into the Gulf of Mexico. Special equipment was needed—and Avondale was ready to build it. Conversions in many cases were advisable—and Avondale took them on. Platforms, pipe jackets, rigs, derrick barges, tugs . . . all of the many and varied units needed—Avondale built them all. As a result, Avondale Marine Ways has an outstanding comprehensive knowledge of the specialized needs of offshore. As for service, Avondale has constantly expanded to provide the best in repair and rig up facilities. The next time you need a job done . . . call in the forces of Avondale.

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P. O. BOX 1030 • NEW ORLEANS

By **RAY L. DUDLEY,** Publisher, and **WARREN L. BAKER,** Editor

Export Buying Improves U. S. Oil Outlook

Market changes from soft to firm position as large scale export purchases due to Middle East crisis relieves nation's surplus supplies of crude oil.

Large purchases of U. S. crude oil to supplement disrupted Middle East shipments to Western Europe have suddenly and completely reversed the U. S. crude oil market outlook. By the end of December it will have shifted from a surplus supply condition to a tight situation, as the full impact of the Suez Canal blockage is felt.

It is estimated that purchases of U. S. crude for export shipments during the next several months already totals 12 million barrels. This is equal to the total volume of crude exported from the U. S. during the year 1955.

Heavy purchases are certain to continue well into 1957. It will take three to four months to clear the canal after cleanup work begins, longer to reshift tanker routings, and at least a year to repair the damage to the Iraq pipe line.

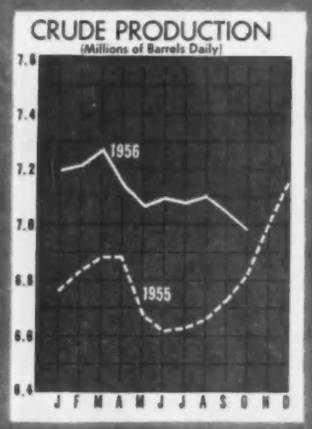
In addition to crude oil purchases, large quantities of both residual and distillate fuel oils are being bought in the U. S. for shipment to Europe. These markets already were relatively tight. They now will become very tight.

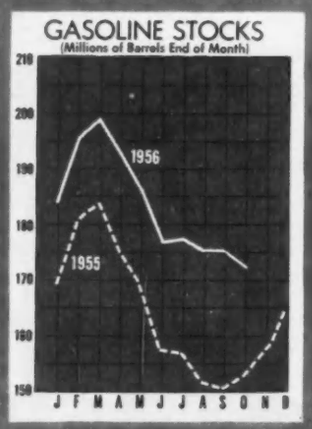
Crude markets were quite shaky until a month ago. This was because of excessive stocks and drastic curtailment of production in many areas.

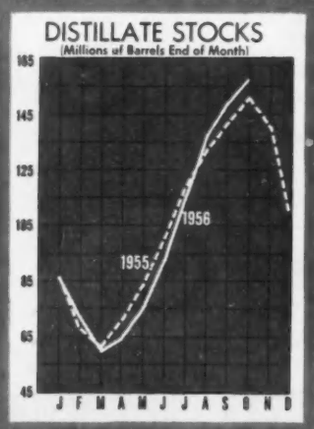
Crude oil markets now are firm and strong, and due to strengthen further in the days ahead. Talk of an increase in crude oil prices has even been revived. Posting of higher crude prices in California has fanned hopes that prices will advance in other areas.

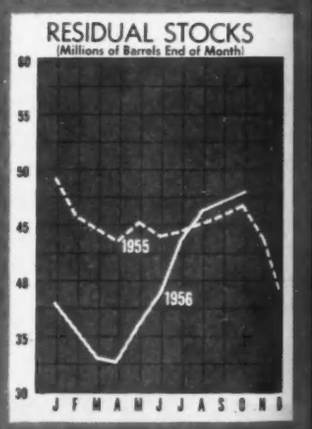
Heavy export shipments to Western Europe are due to relieve the U. S. of surplus crude oil stocks, which on November 1 were 26 million barrels

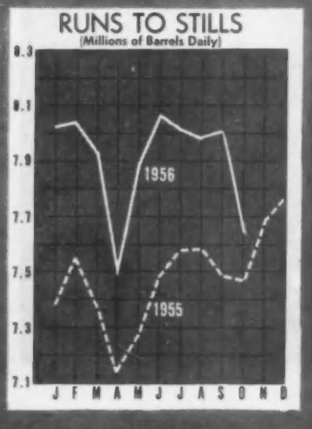
Petroleum Trends . . .

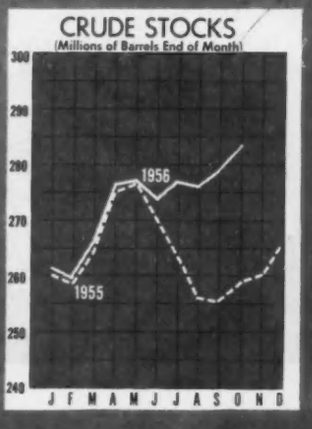


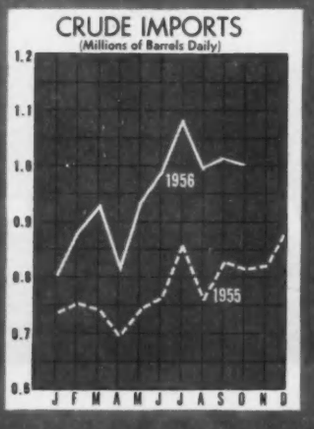


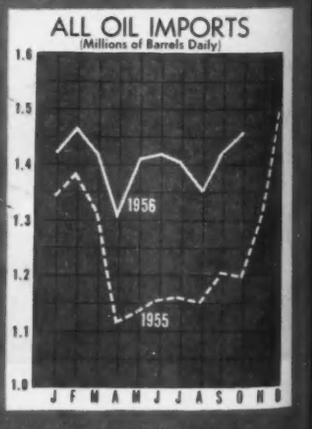












larger than a year ago and causing considerable concern. In addition, U. S. production will show a sharp increase. Producing allowables in Louisiana have been increased by 109,000 barrels daily, and by 75,000 barrels per day in Texas.

Tanker sailing schedules indicate that the latter part of November will see about 20 tankers load approximately 3 million barrels of oil from the Port of Houston alone for export to Europe. Liftings also will be made from other U. S. ports.

These movements are but the beginning. Larger export shipments will come in December and January.

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Much will depend on the availability of tankers and the ability of U. S. pipe lines to move crude from the oil fields to seaports. Both tankers and pipe lines will be bottlenecks which will place some limitation on the volume that can be shipped from the U. S.

According to reports some 40 tankers will be taken out of the U. S. mothball fleet, with some of them already in service. Even this will not be enough tankers to fully satisfy the needs of western Europe.

U. S. pipe lines do not have sufficient unused capacity to transport enough oil to seaports to fully satisfy Europe's needs. It is doubtful that pipe line companies will be inclined to make any heavy investments to increase the capacity appreciably, as the Suez crisis may be over before sufficient income could be realized.

Consequently, Venezuela also is going to benefit substantially from the situation. Again, limited pipe line capacity will determine the volume moved from Venezuela to Europe.

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Little gasoline has been purchased for shipment to Europe so far. However, with gasoline rationing starting in Europe increased purchases of motor fuel can be expected. How much will depend upon the availability of tankers.

Europe will want crude oil and fuel oils first. Then if there is enough tanker capacity remaining gasoline will be purchased.

This would be most welcome to the U. S. oil industry. It has a surplus of gasoline, with stocks 20 million barrels larger than a year ago. It is the one remaining weakness in the U. S. oil market picture.

U. S. Crude Oil and Refined Product Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1955:											
February	6,835	7,549	258,630	3,655	181,643	1,847	68,513	1,239	46,042	751	1,379
March	6,886	7,374	264,430	3,543	183,972	1,703	62,457	1,185	44,970	742	1,319
April	6,887	7,136	275,232	3,502	175,601	1,534	70,139	1,110	43,838	697	1,123
May	6,677	7,281	276,948	3,605	168,751	1,519	83,559	1,111	45,083	742	1,137
June	6,613	7,484	270,850	3,725	157,439	1,628	100,652	1,080	44,398	764	1,159
July	6,632	7,580	264,601	3,824	157,079	1,575	119,169	1,091	44,894	860	1,161
August	6,665	7,580	256,427	3,858	151,912	1,621	133,675	1,090	45,480	756	1,155
September	6,731	7,483	256,269	3,784	150,194	1,621	143,248	1,061	46,267	829	1,218
October	6,831	7,465	267,346	3,827	153,103	1,612	152,288	1,123	47,040	821	1,206
November	7,014	7,692	260,707	3,867	157,871	1,680	141,808	1,214	44,071	823	1,322
December	7,155	7,762	265,610	3,916	165,433	1,765	111,333	1,286	39,174	884	1,502
1956:											
January	7,199	8,023	261,592	3,927	183,905	1,923	86,141	1,344	38,247	805	1,422
February	7,208	8,047	259,504	3,854	196,092	1,918	71,335	1,286	35,673	878	1,472
March	7,278	7,914	265,683	3,829	199,698	1,808	60,846	1,213	32,984	934	1,425
April	7,146	7,487	277,121	3,646	193,299	1,713	63,571	1,130	32,740	815	1,305
May	7,064	7,896	277,497	3,859	186,673	1,667	75,928	1,149	36,607	938	1,416
June	7,100	8,071	274,491	3,976	177,076	1,755	93,758	1,098	39,073	987	1,426
July	7,090	8,014	277,008	3,975	176,536	1,767	115,787	1,066	43,958	1,084	1,463
August	7,195	7,995	279,944	4,037	172,939	1,839	137,905	1,091	46,617	1,001	1,399
September	7,046	8,011	278,415	3,923	175,268	1,819	149,751	1,102	47,413	1,017	1,421
October	6,996	7,638	283,164	3,744	172,534	1,776	158,483	1,107	47,988	1,005	1,461
Week Ended:											
11-9-56	7,050	7,964	281,903	3,816	171,843	1,756	161,656	1,182	47,425	798	1,220
11-11-55	7,007	7,553	257,839	3,687	152,084	1,584	150,606	1,118	45,761	820	1,218

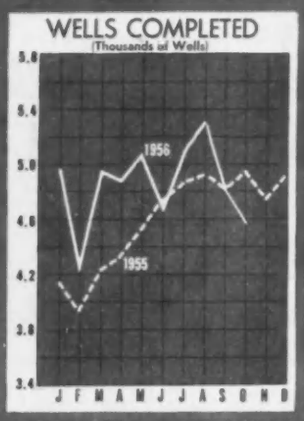
Source: Data for last two months from API; prior monthly data from Bureau of Mines.

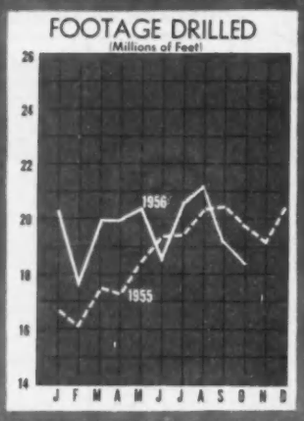
U. S. Crude Production

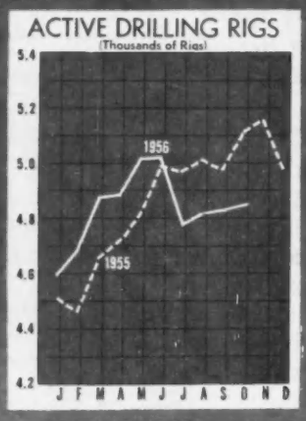
(THOUSANDS OF BARRELS)

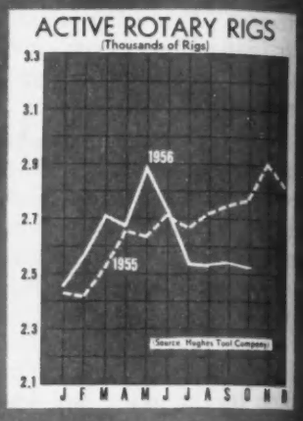
STATE or DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL PRODUCTION		
	Oct., 1956	Sept., 1956	Oct., 1955	% Diff. October 1956-1955	1956	1955	% Diff. 1956-1955
Alabama	10.2	9.2	3.7	+175.7	2,346	1,123	+108.9
Arkansas	77.7	79.6	77.3	+ 0.5	24,019	23,820	+ 0.8
California	955.5	958.8	967.4	— 1.2	293,875	295,220	— 0.5
Colorado	158.6	160.0	150.1	+ 5.7	49,061	41,726	+ 17.6
Florida	1.3	1.3	1.4	— 7.2	405	406	— 0.3
Illinois	235.6	235.8	222.6	+ 5.8	69,228	67,654	+ 2.3
Indiana	31.6	31.4	30.8	+ 2.6	9,088	9,159	— 0.8
Kansas	335.2	338.5	332.7	+ 0.8	103,956	101,439	+ 2.5
Kentucky	47.1	46.8	43.6	+ 8.0	14,541	12,577	+ 15.6
Louisiana	796.0	788.7	755.7	+ 5.3	243,803	220,504	+ 10.6
North Louisiana	120.1	121.4	120.3	— 0.2	38,341	36,268	+ 5.7
South Louisiana	675.9	667.3	635.4	+ 6.4	205,462	184,236	+ 11.5
Michigan	26.8	28.2	29.6	— 9.5	9,030	9,438	— 4.3
Mississippi	113.6	113.4	109.8	+ 3.5	33,910	30,533	+ 11.1
Missouri	0.2	0.2	0.2	.....	50	55	— 9.1
Montana	65.0	64.0	38.8	+ 67.5	17,912	12,863	+ 39.3
Nebraska	38.5	38.5	29.4	+ 31.0	12,803	7,779	+ 64.6
Nevada	0.2	0.2	0.1	+100.0	59	53	+ 11.3
New Mexico	242.3	239.8	232.4	+ 4.3	72,736	67,843	+ 7.2
Southeast New Mexico	240.5	238.0	229.6	+ 4.7	71,724	66,990	+ 7.1
Northwest New Mexico	1.8	1.8	2.8	— 35.7	1,012	853	+ 18.6
New York	7.7	7.9	7.6	+ 1.3	2,320	2,445	— 5.1
North Dakota	26.5	33.0	22.5	+ 17.8	10,722	8,852	+ 21.1
Ohio	13.7	13.9	12.2	+ 12.3	3,973	3,560	+ 11.6
Oklahoma	560.6	580.4	553.8	+ 1.2	179,569	166,983	+ 7.5
Pennsylvania	22.8	22.6	23.1	— 1.3	6,874	7,075	— 2.9
South Dakota	0.1	0.1	.....	.....	25	26	— 3.9
Tennessee	0.1	0.1	.....	.....	14	14	.....
Texas	2,932.5	2,958.8	2,894.8	+ 1.3	924,188	874,052	+ 5.7
District 1—South Central	56.6	56.4	50.6	+ 11.9	16,685	15,445	+ 8.0
District 2—Middle Gulf	149.1	150.2	152.0	— 1.9	47,539	45,634	+ 4.2
District 3—Upper Gulf	435.5	441.2	431.9	+ 0.8	137,882	137,180	+ 0.5
District 4—Lower Gulf-S.W.	233.4	240.2	241.9	— 3.5	74,260	74,077	+ 0.2
District 5—East Central	41.2	42.6	51.2	— 19.5	13,649	14,737	— 7.4
District 6—Northeast	323.4	330.7	340.9	— 5.1	104,243	104,659	— 0.4
District 7-B—North Central	157.8	159.0	149.1	+ 5.8	47,766	43,261	+ 10.4
District 7-C—West Central	174.4	182.8	169.2	+ 3.1	56,263	55,519	+ 1.3
District 8—West	1,047.3	1,041.5	932.2	+ 12.3	319,050	284,041	+ 12.3
District 9—North	211.5	213.2	205.8	+ 2.8	64,452	60,449	+ 6.5
District 10—Panhandle	102.3	100.8	90.2	+ 13.4	29,421	26,325	+ 11.8
Utah	6.8	5.5	7.0	— 2.9	1,722	1,794	— 4.0
Virginia	0.1	0.1	0.1	.....	9	10	— 10.0
West Virginia	6.1	6.1	5.9	+ 3.4	1,845	1,945	— 5.2
Wyoming	283.6	283.1	274.7	+ 3.2	87,198	83,363	+ 4.6
TOTAL UNITED STATES	6,996.1	7,046.0	6,831.3	+ 2.4	2,175,281	2,052,311	+ 6.0

Drilling Activity . . .









Lack of Pipe Hits Drilling

By CECIL W. SMITH, WORLD OIL Staff

FEWER WELLS were completed during October than were recorded in September to mark the second consecutive month that the nation's drilling rates bore the brunt of pipe shortages brought on by the recent steel strike. Ordinarily, October is one of the most active months of the year, but so far it has been the second slowest in 1956.

This year's drilling activity reached its peak in August, but a month later the number of wells being completed had dropped 10 percent, and in October that rate had dropped another 4½ percent.

The remaining two months in this year should see some recovery, but the increase will be moderate. The number of active drilling rigs hit the year's low point at the end of July as the tubular goods shortage pinch became acute. Since then rigs have found their way back to the fields at a very slow rate, and at the end of October were still 154 fewer than were at work at June's peak.

The supply of tubular goods available for drilling will probably continue to be critical through next year. It has been estimated that pipe supply this year has failed by more than 18 percent of meeting demand, and that in 1957 tubular demand will exceed supplies by 4 percent. By 1958, the supply and demand picture should be in fairly good balance.

October's new wells totaled 4592 to show a decline of 215 from the 4807 drilled in September, and 746 fewer than the peak 5338 recorded in August. New wells numbered 5015 during October of last year when drillers had no shortage problems.

In the first ten months of 1956, a total of 48,812 new wells were completed to top last year's 45,818 by 6.5 percent, but this lead was cut back substantially during the past two months. It appears that the final count for the year will fall short of pre-strike forecasts by more than 1000 tests.

Pipe shortages are more clearly evident in footage drilled statistics than they are in well data. While the number of wells drilled this year holds a 6.5 percent lead over last year's record, footage drilled topped last year's by only 5.6 percent. In other words, the average depth of each well drilled this year has been 4044 feet, while a year earlier the average had been 4082. This year's average depth has been lowered considerably since the start of the pipe shortage.

Through July, this year's wells were averaging 4066 feet each, but each succeeding month saw this figure decrease. August's and September's tests did not measure up to the 4000-foot average, and October's barely hit 4010 feet on the average. This decline in average depth can most likely be attributed to the shortness of tubular goods.

At the end of October, 4865 drilling rigs were busy. That being a gain of only 37 during the month, but it was an increase of 90 units since the big drop in active rigs occurred.

Summary of U. S. Wildcat Drilling

ITEM	Oct., 1956	Sept., 1956	TEN MONTHS January-October 1956	1955	Percent Diff.
New Field Discoveries:					
Oil	83	86	901	908	— 0.8
Distillate	5	10	91	108	—15.8
Gas	25	23	201	185	+ 8.6
Total Discoveries	113	119	1,193	1,201	— 0.7
Dry Wildcats	853	943	9,192	8,229	+11.7
Total Wildcats	966	1,062	10,385	9,430	+10.1
Percent Productive	11.7	11.2	11.5	12.7	
Percent Dry	88.3	88.8	88.5	87.3	

(See Page 108 for details)

Summary of U. S. Drilling Activities

ITEM	Oct., 1956	Sept., 1956	TEN MONTHS January-October 1956	1955	Percent Diff.
New Wells Completed:					
Oil	2,398	2,428	25,845	25,245	+ 2.4
Distillate	32	52	469	635	—26.2
Gas	352	341	3,318	2,764	+20.0
Service	99	101	815	558	+46.1
Dry	1,711	1,885	18,365	16,616	+10.6
Total Wells	4,592	4,807	48,812	45,818	+ 6.5
Footage Drilled (Mln. of Feet)	18.4	19.0	197.4	187.0	+ 5.6

(See Page 108 for details)

Sharp eyes follow your Bethlehem drop forging

No need to point out that the making of a good drop forging requires sharp eyes. But at Bethlehem, we like to feel that the eyes are a little sharper than usual. That's just a way of saying every operation is watched with particular care.

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Bethlehem offers a thoroughly integrated set-up, one that produces a huge variety of drop-forge designs. Every aspect of the service is strictly first-class. If care and alertness are extras that you value, it will be to your advantage to call us.

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U. S. Drilling Activity in October and First Ten Months, 1956-1955

STATE or DISTRICT	TOTAL NEW WELLS COMPLETED AND FOOTAGE DRILLED: DETAILS FOR OCT., 1956 — Oil	Dist.	Gas	Dry	Service Wells	TOTAL NEW WELLS — Oct. 1956	Sept. 1956	Oct. 1955	Total Footage — Oct. 1956	DETAILS FOR JANUARY-OCTOBER — NEW WELLS — 1956	1955	Percent Diff.	FOOTAGE — 1956	1955	WILDCAT DRILLING IN OCTOBER AND FIRST TEN MONTHS, 1956-1955 — DETAILS FOR OCTOBER, 1956 — Oil	Dist.	Gas	Dry	Total Wildcats	DETAILS FOR JANUARY-OCTOBER — Oil	Dist.	Gas	Dry	TOTAL WILDCATS — 1956	1955	DRILLING RIGS IN OPERATION — Oct., 31, 1956	Sept. 30, 1956	Oct. 31, 1955
Alabama	6	....	1	1	....	8	5	1	67,922	76	36	+111.1	639,402	157,395	....	....	1	1	2	....	....	2	20	22	34	13	11	9
Arizona	....	....	....	....	....	....	....	....	....	7	4	+ 75.0	22,048	16,136	....	....	....	....	....	....	....	2	5	7	4	....	1	....
Arkansas	81	....	3	23	....	107	110	74	311,963	815	650	+ 25.4	2,469,298	2,128,049	1	....	1	10	12	11	....	4	109	124	114	75	61	65
California	125	....	9	36	....	170	178	218	720,271	1,793	1,994	— 10.1	8,330,233	9,840,258	2	....	....	19	21	10	....	7	218	235	275	197	196	239
Colorado	21	....	8	80	....	109	107	147	528,672	1,064	1,282	— 17.0	5,460,757	6,877,338	3	....	1	64	68	23	1	10	530	564	626	78	81	108
Florida	....	....	....	3	....	3	1	....	20,702	12	24	— 50.0	70,707	162,536	....	....	....	3	3	....	....	....	12	12	23	2	5	2
Georgia	....	....	....	2	....	2	....	....	8,141	7	1	+600.0	30,149	4,130	....	....	....	2	2	....	....	....	7	7	1	1	1	2
Idaho	....	....	....	....	....	....	....	....	....	1	3	— 66.7	4,528	11,337	....	....	....	....	....	....	....	....	1	1	2	....	2	....
Illinois	113	....	13	167	....	293	398	378	667,304	3,157	3,186	— 0.9	7,333,267	7,667,836	1	....	....	72	73	16	....	1	805	822	590	277	264	318
Indiana	15	....	2	43	....	60	65	47	107,064	564	515	+ 9.5	984,951	799,992	....	....	....	13	13	2	....	....	136	138	150	107	107	91
Kansas	185	....	29	166	8	388	392	393	1,399,164	3,886	3,855	+ 0.8	13,735,226	14,717,256	9	....	7	85	101	135	....	35	867	1,037	804	534	510	480
Kentucky	65	....	17	84	....	166	173	171	251,369	1,580	1,376	+ 14.8	2,346,302	2,086,363	2	....	....	9	11	6	....	....	121	127	79	120	122	126
Louisiana	170	1	40	109	1	321	341	387	2,258,701	3,101	3,503	— 11.5	22,765,231	22,777,129	5	1	2	41	49	38	27	16	466	547	412	411	390	378
North Louisiana	93	1	13	44	....	151	172	209	518,899	1,353	1,781	— 24.0	4,890,210	5,550,146	2	1	....	18	21	10	2	2	181	195	163	79	71	86
South Louisiana	77	....	27	65	1	170	169	178	1,739,802	1,748	1,722	+ 1.5	17,875,021	17,226,983	3	....	2	23	28	28	25	14	285	352	249	332	319	292
* Gulf of Mexico	21	....	6	15	....	42	25	30	422,788	360	277	+ 30.0	3,403,527	2,585,545	1	....	1	1	3	5	5	5	41	56	30	56	47	50
Maryland	....	....	....	....	....	....	....	....	....	4	....	+400.0	30,716	....	....	....	....	....	....	....	....	....	....	....	....	1	1	2
Michigan	19	....	1	11	....	31	32	51	83,871	367	443	+ 17.2	1,043,796	1,317,169	....	....	1	10	11	4	....	2	128	134	168	72	65	85
Mississippi	11	....	1	22	....	34	42	39	270,910	362	379	— 4.5	2,623,926	2,759,602	2	....	....	16	18	9	2	....	155	166	143	35	37	40
Missouri	....	....	3	1	....	4	....	....	3,342	25	24	+ 4.2	27,153	13,095	....	....	....	1	1	....	....	....	16	16	17	1	3	3
Montana	15	....	....	24	1	40	60	37	206,244	414	292	+ 41.8	2,061,080	1,438,923	1	....	....	19	20	7	....	2	156	165	114	60	63	50
Nebraska	21	....	....	39	....	60	63	89	338,648	791	709	+ 11.6	4,568,923	4,087,315	3	....	....	28	31	37	....	1	344	382	279	24	26	57
Nevada	....	....	....	....	....	....	....	....	....	5	6	— 16.7	28,571	44,828	....	....	....	....	....	....	....	....	3	3	4	5	4	1
New Mexico	75	....	49	36	....	160	143	165	733,518	1,646	1,433	+ 14.9	7,404,636	6,111,007	3	....	....	24	27	34	1	1	199	235	117	175	188	157
New York	26	....	3	3	18	50	50	37	81,750	396	303	+ 30.7	566,600	418,057	....	....	....	....	....	....	....	....	....	....	....	68	70	51
North Dakota	20	....	....	11	....	31	24	28	198,404	240	217	+ 10.6	1,758,135	1,524,162	....	....	....	9	9	9	....	....	65	74	55	26	26	22
Ohio	47	....	19	23	....	89	75	113	203,583	861	992	— 13.2	2,069,670	2,067,179	....	....	....	....	....	....	....	....	3	3	15	225	222	218
Oklahoma	331	3	30	175	20	559	570	690	1,951,187	6,584	6,400	+ 2.9	23,497,884	22,132,060	6	....	4	45	55	83	13	29	565	690	539	572	577	669
Oregon	....	....	....	....	....	....	....	....	....	1	1	....	12,880	7,101	....	....	....	....	....	....	....	....	1	1	1	....	....	....
Pennsylvania	31	....	25	4	33	93	95	64	242,073	751	614	+ 22.3	2,036,185	1,165,369	....	....	....	....	....	....	....	....	....	....	2	178	175	132
South Dakota	....	....	....	1	....	1	2	3	2,000	17	12	+ 41.7	60,965	52,476	....	....	....	....	....	....	....	....	16	16	12	3	4	1
Texas	982	28	47	590	18	1,665	1,716	1,685	7,237,767	18,817	16,267	+ 15.7	79,857,356	71,540,376	42	4	7	349	402	462	45	82	3,977	4,566	3,415	1,284	1,294	1,457
Dist. 1: South Central	76	1	3	76	....	156	146	179	378,717	1,721	1,484	+ 16.0	4,457,287	3,927,487	2	....	....	53	55	21	1	5	440	467	339	41	39	61
Dist. 2: Middle Gulf	20	9	6	30	....	65	71	75	404,262	696	676	+ 3.0	4,308,693	4,041,746	1	1	2	19	23	12	7	7	210	236	207	32	40	45
Dist. 3: Upper Gulf	72	8	9	57	....	146	152	166	1,010,094	1,508	1,494	+ 0.9	10,241,920	9,623,905	2	1	....	24	27	19	8	4	365	396	349	155	148	145
* Gulf of Mexico	....	....	1	3	....	4	2	3	41,830	13	13	....	138,490	126,392	....	....	....	3	3	....	....	....	9	9	4	6	5	3
Dist. 4: Lower Gulf-S.W.	46	10	6	43	....	105	111	107	535,941	1,211	1,124	+ 7.7	6,322,917	5,944,610	2	2	....	26	30	21	17	19	358	415	331	87	72	94
* Gulf of Mexico	....	1	....	....	....	1	2	....	8,085	11	12	— 8.3	97,098	115,549	....	....	....	....	....	....	....	....	1	1	3	3	3	3
Dist. 5: East Central	1	....	....	15	....	16	20	20	90,744	205	217	— 5.5	720,850	846,620	....	....	....	13	13	....	....	....	117	117	115	7	11	14
Dist. 6: Northeast	53	....	4	34	....	91	90	63	506,714	780	599	+ 30.2	4,180,535	3,192,983	....	....	....	22	22	11	1	2	185	199	151	67	82	64
Dist. 7-B: North Central	98	....	4	87	1	190	246	264	741,319	2,558	2,573	— 0.6	9,118,774	8,311,547	11	....	3	53	67	145	....	15	805	965	760	115	120	162
Dist. 7-C: West Central	50	....	1	23	....	74	96	91	372,156	1,077	978	+ 10.1	4,933,220	5,295,695	5	....	....	19	24	42	....	2	238	282	222	110	122	110
Dist. 8: West	272	....	2	51	14	339	285	360	1,731,140	3,569	3,206	+ 11.3	18,365,186	17,456,992	9	....	....	26	35	86	3	2	344	435	365	339	327	420
Dist. 9: North	208	....	1	160	3	372	384	285	1,012,864	4,301	3,101	+ 38.7	12,481,015	10,012,674	9	....	....	85	94	86	2	8	835	931	536	235	230	249
Dist. 10: Panhandle	86	....	11	14	....	111	115	75	453,816	1,191	815	+ 46.1	4,726,959	2,886,117	1	....	2	9	12	19	6	18	80	123	40	96	103	93
Utah	6	....	....	4	....	10	8	8	42,486	115	87	+ 32.2	541,072	380,591	2	....	....	4	6	6	....	3	65	74	60	35	31	29
Washington	....	....	....	....	....	....	....	....	....	1	....	+100.0	7,493	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....
West Virginia	6	....	43	8	....	57	63	61	156,903	587	538	+ 9.1	1,577,577	1,427,279	....	....	....	....	....	....	....	....	....	....	13	196	190	198
Wyoming	27	....	9	45	....	81	94	129	319,465	765	672	+ 13.8	3,405,780	3,310,496	1	....	1	29	31	9	2	4	201	216	161	90	101	134
Total United States	2,398	32	352	1,711	99	4,592	4,807	5,015	18,413,424	48,812	45,818	+ 6.5	197,372,497	187,042,840	83	5	25	853	966	901	91	201	9,192	10,385	8,229	4,865	4,828	5,124
Total Western Canada	151	....	2	8	....	161	238	151	713,092	2,333	2,133	+ 9.4	10,937,467	9,158,364	....	....	....	....	....	....	....	....	....	....	....	218	226	219

* Gulf of Mexico wells are included in their respective district totals.

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Magnetic Tape Recording Gains Popularity

Magnetic tape has undoubtedly been one of the greatest contributions to the field of geophysical recording during the past decade. Equipped with this facility, the seismologist builds recordings with minute detail and, as a result, heretofore questionable subsurface structure is being better defined. Furthermore, the problem of record keeping is greatly simplified with the use of magnetic recording media. Bulky paper tape, time consuming developing processes and fragile records have become a thing of the past.

The April 1956 Exploration Issue of WORLD OIL pointed to the outstanding advantages then available through use of magnetic media for geophysical recording. And now, just seven months since the date of the April report, the seismologist is in a position to report additional findings in the use of magnetic tape and disc materials.

Field performance, laboratory characteristics and the compilation of data by mechanical means are herewith reported by authorities in the field.

Field Application

The use of magnetic recording tape as a medium for permanently recording seismic signals has proven to be a most definite asset to the geophysicist toward the solution of obtaining the best records possible from the good to the most difficult record areas.

By ALAN D. WALDIE
McCollum Exploration Company
Houston

THE ABILITY OF magnetic tape to permanently store seismic recordings as readily replayable signal voltages is, by its own nature, the greatest single advantage in its use as a new seismic tool. This one feature, when compared to the basic field recording made solely by photographic means, opens the way to a host of new techniques such as broad-band recording, electrical mixing, static and dynamic time correcting and electrical composite, or integration of geophysical signals. Heretofore most of these would have been highly impractical and laborious tasks to accomplish.

Since the original energy can be so easily re-created during playback of field recordings made on magnetic tape, much time and expense can be saved in the field by first making a basic broad-band recording. The record may then be filtered by multiple replays in the field or central office equipment when making the photographic seismogram.

Taped records can become a part of the permanent file of areas covered and may be used in future replays when "tying in" with additional program in these areas without re-shooting the areas already covered.

The invention of magnetic recording has made practical many new field techniques of seismic exploration. Sequential recording of seismic energies created by such devices as the weight-dropping method, or by multiple shots fired sequentially from the same hole, would be highly impractical without magnetic recording. The weight drop recordings are made on magnetic tape and later corrected during playback for variations in the time-of-fall of each weight drop,

weathering, elevation and normal moveout. After the signals have all corrections applied, including dip correction, if necessary, they are then electrically combined, or integrated into a composite voltage to improve the signal-to-noise ratio of the seismic data recorded. Filtering is then selected and applied to final signals as they are made into the photographic seismograms for interpretation.

One contract company and several manufacturers of geophysical equipment are offering magnetic recording systems which are capable of making all corrections mentioned above, plus other features, such as electrical mixing, time-to-depth correcting and variable density record presentation. Some companies are working toward automation of these various techniques to the point of presenting a completed cross-section made automatically by these magnetic recording systems.

No one can fully predict what changes the introduction of magnetic recording will eventually dictate to the future design of the "typical geophysical field crew," but the many already present advantages of magnetic recording have proven the potential value of its existence.

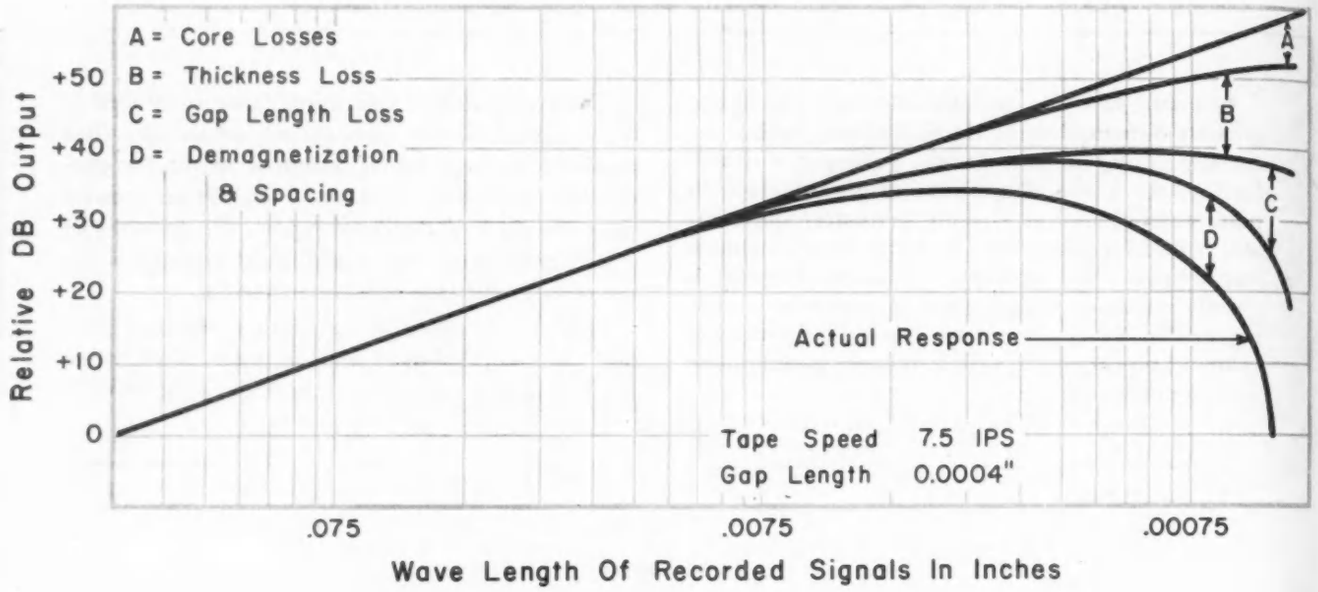

FIGURE 1—Frequency response of magnetic tape recording systems.

Frequency Response

The frequency response of a tape recording system is dependent upon two factors:

The sensitivity or capability of the tape.

The electronic system including the record and playback heads.

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ORRadio Industries, Inc.
Opelika, Ala.

THERE IS A general rule of thumb which says that using standard data techniques, a magnetic recording system can record and play back frequencies from about 40 cps to an upper limit which will be determined by the tape speed. This upper limit is approximately 2 Kcps for each ips of tape speed. By this we mean a recording system which operates at a tape speed of 10 ips may record and reproduce frequencies from 40 cps to approximately 20 Kcps.

Electronic circuitry can be designed to give a fequency band pass of d - c to several megacycles per second. It is not the practice to extend the frequency response of the electronics in the recording system because the frequency limitations in a system are the limitations of the recording and playback heads to a large extent.

Figure 1 shows a typical magnetic recording frequency response curve. This curve is not typical of any specific system, but is true in a general nature of a curve which would be obtained by holding the recording current constant for all frequencies and then measuring the open circuit voltage from the reproducing head.

If the losses that occur in a recording head are neglected and if a constant signal current regardless of frequency is maintained in the recording head, then the magnetic recording tape as it passes the gap of the recording head will be magnetized in proportion to the signal current. Major losses in the system occur in the reproducing process.

Ideally, the open circuit output voltage of the playback head will rise at the rate of 6 db per octave, as shown by the straight line in Figure 1, because the playback head output voltage is proportional to the frequency. There are two types of losses which will subtract from this straight

line response. Losses due to signal frequency are usually small and in heads which are available today are significant only at the higher frequencies. Most significant frequency loss is called the core loss (loss A). Losses due to wave length of the recorded signal are the thickness loss and the gap length effect loss. The thickness loss (loss B) is proportional to the thickness of the oxide coating on the tape. For this loss to be rendered insignificant, the thickness of the oxide coating must be in the order of one-tenth or less of the recorded wave length of the highest recorded frequency. As shown by the graph, thickness of the coating has a less important effect on lower frequencies.

The gap length loss (loss C) is due to the fact that the reproducing head integrates a portion of the magnetic field in the medium. If the gap length of the playback head is equal to the wave length of the recorded signal, there will be a zero output voltage.

The remaining loss (loss D) is due to either demagnetization effects, the magnetized coating demagnetizes itself, or it is due to spacing; there is always an actual gap between the playback head and the tape.

The electronic circuitry is designed to eliminate the "hump" in the "actual response" curve of Figure 1. This is called equalization. Frequency limitations of the system are determined by the points where the actual response gets too low.

Seismic Data Processing

Recent widespread adoption of magnetic recording of seismic data has intensified interest in mechanized automatic means of data processing. The use of reliable reproducible recording equipment provides potential means of storing much more information than can be feasibly stored on paper records.

By HAL T. JONES
Houston Technical Laboratories
Houston

STANDARD METHODS of seismic data processing involve visual detection of the event arrival times on the original records and subsequent corrections and computations based upon these event times. These operations lead, after considerable tedious computational labor, to two-dimensional subsurface cross-sections plotted in terms of surface distance versus time or depth which often form the chief basis for subsurface interpretations. The sections present the information from a number of records in a single chunk. Clearly, the same end can be achieved if the entire original trace can be properly corrected and placed in its proper relative position on a time section, thereby eliminating tedious computation and plotting. This has been partially accomplished for a number of years by means of composite record sections prepared photographically.[3]

Use of these record sections, however, was adversely affected by inability to adjust individual traces for time differences due, for example, to weathering and elevation differences and to normal moveout. Since the interpretation of seismic data depends, at present, ultimately upon visual detection of the events and patterns of events, whether on the original records or on the record sections, the utility of time corrections before the records are picked and before the cross-section itself is made is clear. Ability to change the relative positions of a set of magnetic record-reproduce heads provides partial means for making such corrections.

The conventional method of seismic data processing involves considerable tedious computational labor. The raw data in the form of analog curves are digitized to event times and collected in tabular form along with associated parameters such as shot-point and receiver coordinates, shot-point-to-receiver distance, elevation, etc. A number of corrections must be applied to the raw times, for example, reduction to a datum plane, weathering corrections, normal moveout corrections, time break and filter corrections. The correction procedure requires computations and/or table or chart lookup procedures and in many cases is one of the most time consuming parts of seismic data processing. The corrected data must be plotted in cross-section form, often after a computation converting vertical time to depth.

Finally, in most areas a number of steep dipping lineups must be migrated into their proper x-z positions. Although the computers may be helped in carrying out the above chores by numerous aids such as desk calculators, tables, slide rules, plotting arms, etc., the work goes slowly, is subject to numerous errors, and does not stimulate the budding geophysicist's creative powers.

The above difficulties can be alleviated by employing a data processing procedure which is a direct mechanical analog of the conventional method in that the same steps are followed in about the same order but in which digital data handling equipment is used to perform the "busy" work.[2] This method employs semi-automatic oscillogram readers to digitize picked records, digital computers to perform time corrections, t-z and migration computations, and automatic x-z plotters to prepare cross-sections. High equipment costs have limited use of this method to large volume applications such as marine work or to central office processing in review work.

Equipments which permit an operation on the played back seismic signals (originally magnetically recorded) in their analog form to obtain a correctly processed record section may be designated as *analog* data processing systems. This is in contrast to the digital systems which convert the data to sets of numbers and operate on these numbers by simple arithmetic steps. Proposals for analog systems in seismic data have been presented many times in the

FIGURE 2—An analog seismic data processing system. Design objectives stresses flexibility, compatibility with a wide variety of magnetic recording equipment, minimum waveform distortion whenever desired, and the ability to prepare a corrected reproducible record for subsequent trace mixing and shot compositing. By replay and mixing of the corrected data, one may store the original data of many records on a single magnetic record. The versatility of this and other new seismic magnetic data processing equipment promises significant advancement in the analysis and presentation of geophysical data for geologic study and interpretation.[1]

relatively short history of geophysical exploration, for example, the work of Rieber.[4] More recently, an analog system utilizing optical and mechanical apparatus has been applied to seismic data processing.[5] Now, systems working directly from the magnetic records to corrected cross-sections and also first preparing corrected magnetic records are becoming commercially available. These systems have the advantage of providing time-corrected data in reproducible form for subsequent mixing and shot compositing.

In the conventional and digital computer methods outlined above, the data are reduced, in other words picked, before a section is prepared although, of course, a considerable amount of reduction and revision may go on as the section is studied. In the reduction procedure, records are normally studied in groups, in other words, in composite record sections. Using the analog apparatus, all or at least most of the data are transferred to the section and reduction is done on the section itself. Some apparatus may compromise slightly in that only limited amounts of the total waveform may be preserved. Presumably, this partial reduction of total information content makes visual detection of signals easier. In any event, the utility of corrected record sections in interpretation is beyond question.

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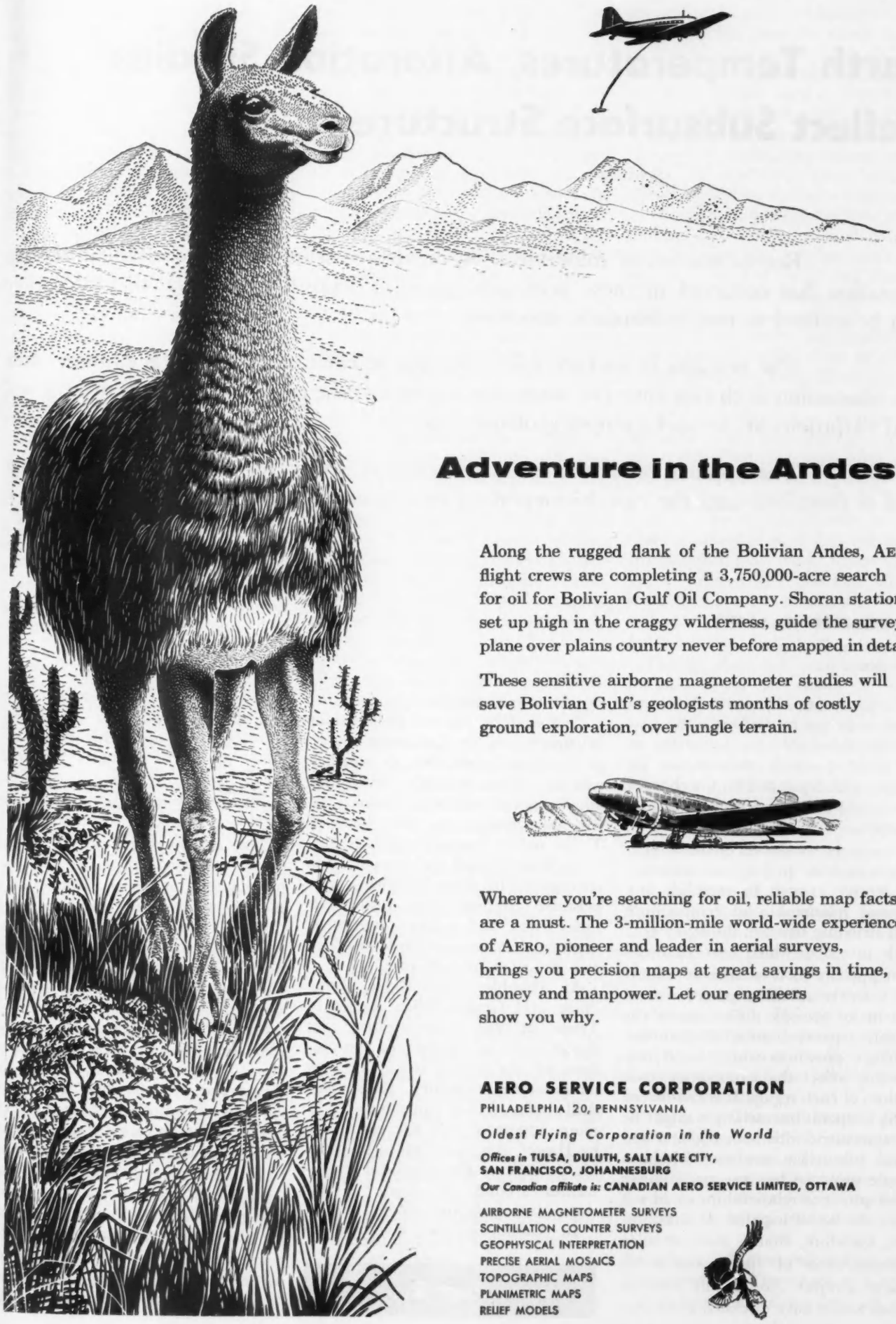

Adventure in the Andes

Along the rugged flank of the Bolivian Andes, AERO flight crews are completing a 3,750,000-acre search for oil for Bolivian Gulf Oil Company. Shoran stations, set up high in the craggy wilderness, guide the survey plane over plains country never before mapped in detail.

These sensitive airborne magnetometer studies will save Bolivian Gulf's geologists months of costly ground exploration, over jungle terrain.

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Earth Temperatures, Alteration Studies Reflect Subsurface Structure

Recent studies of mineralization in surface sediments have established that alteration has occurred in these beds subsequent to deposition and that this alteration can be utilized to map subsurface structure.

The relation of surface mineralization to earth temperature is explored and the conclusion is drawn that the alteration represents the cumulative effects of geothermal variations at the surface over geologic time.

The application of the surface alteration study as a structural mapping tool is described and the case history of an experimental project is outlined.

By BERNARD H. LASKY
Consulting Geologist
Houston

ONE OF THE objectives of the investigation was to determine the conditions responsible for variations in the rate at which temperature increases with depth and for the changes that take place between one area and another.

It was the conclusion of the investigators that the project was not comprehensive enough to establish any general relationship of temperature and structure between the many geologic provinces which were studied.

It appears to be extremely doubtful if any relationship exists for there are major geologic differences in the widely separated areas of dissimilar geologic provinces which could reasonably affect the temperature conditions of each region. It is considered that temperature variations might be in agreement with both regional and local subsurface structure within a single province but any quantitative inter-province relationships could not logically be anticipated. It is apparent, therefore, that a more detailed concentration of the investigations under Project No. 25 in separate areas would have disclosed additional significant information.

Temperature investigations in Wyoming and in California, made previous to Project No. 25 together with the project studies in the Garber and Cromwell fields of Oklahoma, at Big Lake, Luling, the salt domes in Texas and at Santa Fe Springs and Long Beach, Calif., all support this conclusion. In these instances, temperature relations were studied in some detail and a close agreement between temperature and structure was indicated in each case.

At Humble, Blue Ridge, Long Point and Grand Saline domes in Texas, it was demonstrated that domes could be located and the outlines of the domes determined by temperatures measured in shallow drill holes. What appeared to be more important was the conclusion by Hawof that it seemed to be possible to indicate the structural irregularities around the flanks of the domes by geothermal studies.

In California the investigations were confined to the determination of temperature conditions in strongly deformed beds of approximately the same age. The results obtained showed conclusively that in the fields of the Los Angeles Basin, temperatures actually reflected structure.

The investigations under Project No. 25 extended over a period of approximately four years. Temperature measurements were made in more than 400 wells in the states of Kansas, Oklahoma, Texas, New Mexico and California. Previous to 1934, Van Orstrand[3] independently, studied temperature conditions in over 250 wells in 23 states. The total of some 650 wells which covers these combined studies in the U. S., can be recognized as affording a meager amount of control data for the resolution of the problems of temperature on both a regional and a local basis.

In spite of these limitations, however, Van Orstrand, in summarizing the results of geothermal surveys up to the year 1934, stated that the evidence shows that variations of temperature have been found to be associated with salt domes, sand

Part 2

lenses, faults and structures with both large and small closures. Van Orstrand concludes that although radioactivity and thermal conduction through oil-bearing strata are possible sources of temperature variations and the generation of heat by the oxidation of petroleum may be of minor importance, the most potent source of heat is to be found in the hot rocks immediately beneath uplifts.

Van Orstrand suggests that geothermal prospecting might constitute a supplementary exploratory tool. The limitations imposed on temperature surveying, however, by the number and locations of suitable wells in which measurements can be taken or the necessity of drilling shallow holes to depths of several hundred feet together with the time factor involved in obtaining accurate determinations, all react to make temperature studies too costly and impractical as a method of mapping the subsurface.

An additional handicap is perhaps of even greater importance. Present-day temperature differentials which have been indicated to reflect the subsurface are relatively small and in the order of magnitude of from 3° to 7° F. These figures represent an average of 5° F. between the crest or hottest part of an anticline and the coldest area of the associated syncline. The average variation, therefore, is approximately 7 percent of the present-day mean surface temperature. Considering this small variation, it is obvious that the temperature survey is not particularly adapted to the accurate delineation of the structural anomalies which constitute an important part of today's exploration problems.

Surface Mineralization or Alteration Studies. It would appear to be illogical to disregard entirely the accumulated data on earth temperatures from the exploration standpoint, particularly at a time when the demands for petroleum are greater than ever before, fields are progressively more difficult to find and geologists and geophysicists must improve present oil finding techniques and develop new tools.

It is generally recognized that temperature constitutes a most important physical factor in the earth sciences because of its critical mechanical and chemical effects. Accordingly, if the temperature survey is impractical as an exploration tool on account of its excessive costs, an important question presents itself. Would it be feasible to measure the possible *effects* of temperature variations on the surface beds and thus attack the problem on an *indirect* rather than a *direct* basis?

The writer's experience in the detailed studies of the surface as a means of determining subsurface structure leads to the conclusion that this may have been accomplished for it has established the fact that there is a relation between surface mineralization and the subsurface which has been found to be quantitatively accurate. Surface mineralization or alteration studies have therefore been utilized as a sub-surface mapping tool.[4]

Superficially, it may be difficult to conceive of such a relationship. Megascopic surface indications of piercement salt domes in the form of paraffin dirt, sulphur and limestone are common. Mineralization has also been observed in the areas of faulting when the trace of the fault reaches the surface. These secondary effects are the results of the structural deformation and its adjustments. They are, however, entirely qualitative and although they may suggest the anomalous structural conditions with which they are found, they do not involve any formal or quantitative relationships with the subsurface structure.

In addition, secondary mineralization has not been observed to be associated with deep-seated domes or structures of the Mid-Continent type. If it exists, the source of the mineralization is less obvious.

In the further examination of the theory of secondary mineralization, it is not reasonable to expect to find minerals of secondary origin on the surface in areas in which one or several unconformities are present. In this instance, mineralization which was the product of the original deformation would be prevented from reaching the surface by the unconformity acting as a barrier to the introduction of minerals to surface beds. Subsequent or post-depositional adjustments are considered to be of minor importance and can be disregarded as a source of surface materialization in such instances.

It is obvious, therefore, that if surface mineralization has been found to be related to the subsurface structure under the wide range of different conditions which has been outlined, this mineralization must necessarily be the indirect rather than the direct result of the deformation. It must also be the product of a force or forces which are at the present time or have been in the past, indigenous to the surface sediments. Under such circumstances, the role of earth temperatures, as a factor in producing these surface effects, should be critically examined.

The mineralization-subsurface relationship has been established by the study of surface samples taken at depths of from 4 to 12 feet. Essentially, a surface and not a near-surface relationship is involved. There are several factors which could produce these effects, modify them or completely neutralize them. These consist of ground waters, stratigraphy, the age of the deformation in an area, the thickness of the beds above the folding, together with the topography and to some extent the areal geology.

As far as ground water is concerned, mineralization studies in the arid regions of West Texas and eastern Colorado gave results which were similar to studies on the Gulf Coast which is subject to considerable rainfall and in which shallow ground water is present.

The age of the deformation and the thickness of the beds above the folding have not been found to be critical, as mineralization studies have succeeded in mapping the subsurface at the comparatively shallow depths of 3500 feet in the Arbuckle Limestone of Kansas and in the Lower Cretaceous at 12,000 feet in Mississippi.

Differences in the stratigraphy of individual areas have not produced any important changes in the results. Studies in Kansas in which samples were taken in the Permian surface and which mapped structure through the Pennsylvanian beds in the Ordovician were essentially similar to studies in which Pleistocene glacial drift in the Michigan Basin was sampled to map structure through the Pennsylvanian and the Mississippian, in the Devonian.

The topography and the areal geology are factors which should be considered for any area. They may affect the results superficially but have been found not to be critical in the mineralization-subsurface relationship.

Relations of Mineralization and Temperature. The results of a mineralization study of an area are ex-

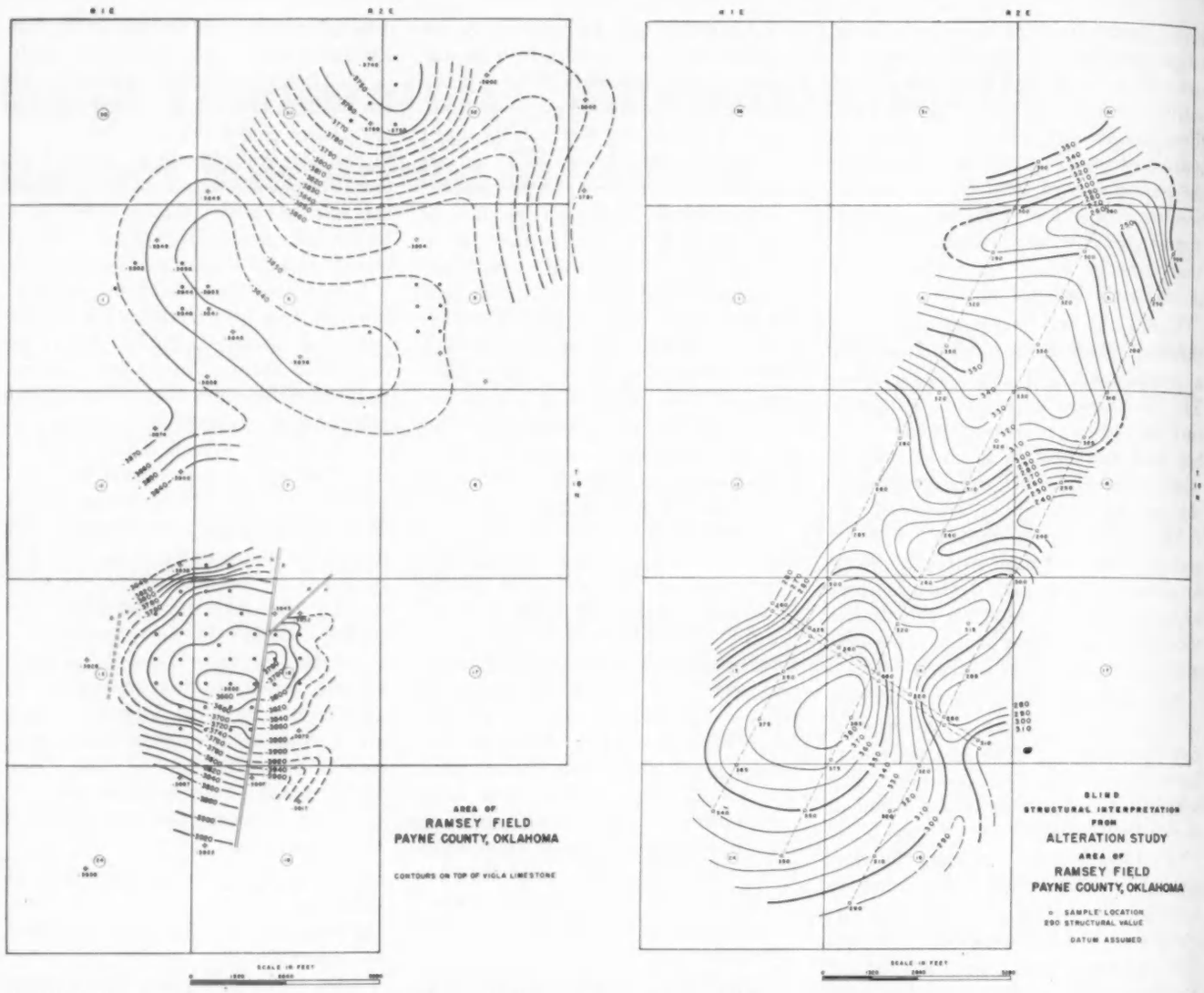

FIGURE 1—Interpretation of the structure of the Ramsey Field area, Payne County, Oklahoma, from blind alteration study and the actual subsurface as indicated by development.

pressed in a contoured map, based on the quantitative determination of one or more critical mineral parameters or controls found at the surface. The mineralization map is in close agreement with the subsurface structure of the area. The mineralization study, therefore, maps subsurface structure. Temperature surveys have been indicated to reflect the subsurface. The end-products of each are generally similar but there are significant differences between the two.

The mineralization map represents a detailed and quantitative delineation of the subsurface structure rather than a qualitative expression of the structure as indicated by the temperature survey. The reason for this difference, is obvious. Temperature surveys require wells in critical locations for measurements and such wells are not generally available. The mineralization study depends entirely upon samples from the surface beds, taken at shallow depths at locations which can be selected at will.

There is another and significant area of difference in the results of the mineralization study and the temperature survey. The temperature differentials which have been found between structurally high areas and the adjacent synclines, represent changes of not to exceed 7 percent of present-day mean surface temperatures. Mineralization differentials are considerably greater in magnitude. It has been found that variations in mineralization between the crest of structures and their synclines may be in the order of magnitude of approximatley 50.0 percent.

A mineralization study has not been made in an area in which temperature investigations have been found to reflect the subsurface. A direct comparison between the results of the mineralization study and the temperature survey is not, therefore, available. Such a comparison would not, however, be conclusive of any fact except that the subsurface has been indicated by both techniques. Nevertheless, the dependence of mineralization effects upon temperature variations appears to be definitely suggested.

The wide divergence in the order of magnitude of mineralization and temperature differentials, concentrates attention to this mineralization-temperature relationship. If mineralization differentials represent the effects of geothermal variations at the surface, these effects by reason of their magnitude, are undoubtedly not the results of present-day temperature differences alone but are the cumulative effects of geothermal variations over geologic time, or the age of the surface beds under consideration.

The writer's conclusion is that

geothermal variations have produced compositional changes or alteration in the surface beds of an area to a degree which does not appear to be possible by any one or a combination of other geologic factors, some of which may be of minor importance. Surface mineralization studies have accordingly been designated as Alteration Studies.

It is important to note that the concepts concerning the mineralization-temperature relation, have been derived in great measure from the results of blind surface studies which have established the intrinsic values of the physical data of the studies, independent of the influence of any knowledge of the geologic or structural conditions of the project areas.

A case history of a typical blind project made for a research organization, follows.

Alteration Study In the Area of Ramsey Field, Payne County, Okla. The area of the Ramsey field, Payne County, Oklahoma, was selected by the Company on account of the fact that the subsurface conditions were known and a critical comparison could be made between the blind interpretation based on the alteration data and the actual subsurface structure of the area.

The company required that the samples were to be analyzed and the basic or "raw" mineralization values reported to the Company before the sample plat for the study was disclosed, in order that the company might be assured that the interpretation, although blind, was based on the mineralization values and in addition to ascertain the degree to which it was influenced by the interpretational procedure.

The conditions under which the study was made, therefore, imposed severe handicaps. They are summarized as follows:

- Samples were submitted by the company from an undisclosed area.
- A sample plat was not furnished until the mineralization values had been reported.
- Blind duplicate and triplicate samples were submitted to check the accuracy of the laboratory determinations and to determine their reproducibility, as samples were submitted at different times.
- The structural interpretation was made after the sample plat was furnished, but this interpretation was essentially blind, as the area was unknown and the directional orientation of the sample plat had not been disclosed.
- The locations of two wells were given with their depths to a key horizon so that some measure of calibration could be made between a subsurface condition and the data of mineralization.

The Ramsey field is located in Sec. 13, T18NR1E and Sec. 18, T18N R2E, Payne County, Oklahoma. It was discovered in 1938. The field is described in detail by Frost.[5] The structure is a flat-topped dome, faulted on the east flank, with steep dips and 130 feet of pre-Pennsylvanian truncation.

Figure 1 shows the structure of the field and the adjacent areas, contoured on the Viola limestone and the blind interpretation of structure from the alteration study.

Reference to Figure 1 shows that the alteration study has delineated the subsurface structure of the Ramsey Field and the adjacent area with a high degree of accuracy in comparison with the subsurface as determined by actual developments. An evaluation of the results follows:

1. The structure of the Ramsey Field proper, as indicated by the alteration study, is in close agreement with the subsurface structure, based on well control. The apex of the structure, as determined by the study, is approximately 1000 feet southwest of the maximum structural elevation of the field and steep dips are shown to the north, east and south. The fault on the east flank of the structure has not been determined but the intense east dip is suggestive of faulting. It is considered that the sample control is not adequate to resolve the faulting and to pinpoint the apex of the dome. It should be noted that the nosing in the northeast quarter of Section 18 which is a minor structural feature, has been mapped with a reasonable degree of accuracy.

2. The alteration study shows a second structure which attains its maximum structural elevation in the southwest quarter of Section 6. This appears to have an east-west axis and it apparently represents the extension of the subsurface high to the west.

3. A third structurally high area is suggested by the anomalous south dip indicated by the study in the southwest quarter of Section 32.

Attention is directed to the high area of Section 6. This structure has a dry hole on its crest which supports the conclusion of the writer that structural mapping by the alteration study is not dependent upon the production of oil and gas in any instance.

It should be noted, also, that the results of the alteration study are independent of topographic effects and the influence of surface structure. In this case, the Ramsey field is located on a long, broad, gently sloping ridge. The topography is rugged and it is not suggestive of the subsurface structure.

There is more than 200 feet of closure at Ramsey on the Wilcox sand but the structure shows a progressive upward decrease in closure and the surface structure is a homocline which dips gently to the southwest.

Summary and Conclusion. The development of the alteration study method dates back to 1943 when experimental work was commenced. The technique has been progressively developed since that time and has been utilized to map subsurface conditions on the Gulf Coast, in West Texas, Louisiana, Mississippi, Oklahoma, Kansas, Colorado, Nebraska and in the glacial drift of the Michigan Basin.

It has not been confined to the mapping of domes, anticlines and faults but has been successful in mapping stratigraphic traps which are the results of truncations, and reef build-ups which are not necessarily superimposed over structural anomalies in the under-lying deeper-seated formations with which they are associated.

A limited amount of data, as yet unsupported by adequate supporting evidence suggests the possibility that the alteration study might be used to outline the non-porous, dry portions of a producing limestone reservoir.

It would appear, therefore, that any anomalous geologic condition, which by reason of its nature and extent, has the ability to influence thermal conductivity in the vertical, could reasonably be suspected of being disclosed by the alteration study.

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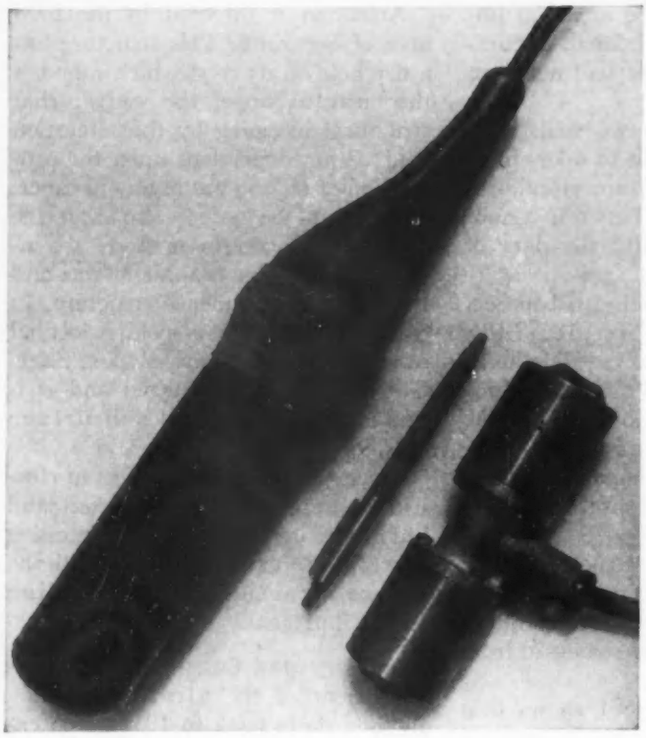
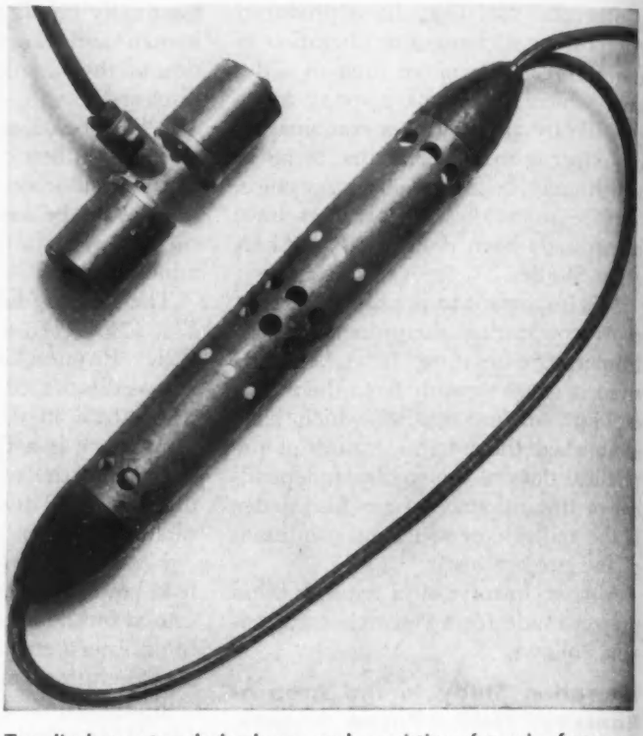


A diaphragm type hydrophone consisting of a pair of pressure sensitive units and a magnetostrictive detector consisting of a single magnetized tube and toroid coil.



Two diaphragm type hydrophones, each consisting of a pair of pressure sensitive detectors. The diaphragms are located at the ends of the small unit and near the center of the large unit. These units may be used singly or in pairs for each trace of a 24 trace floating cable.

New Techniques in Marine Geophysics

A combination of recently introduced offshore exploration methods permits completion of a survey in 300 percent less time than is required on land. More sensitive instruments have been developed to screen out interference from wave motion and other exterior disturbances.

By T. R. GOEDICKE and E. R. LOCKE
Offshore Exploration Groups, Inc.
Houston

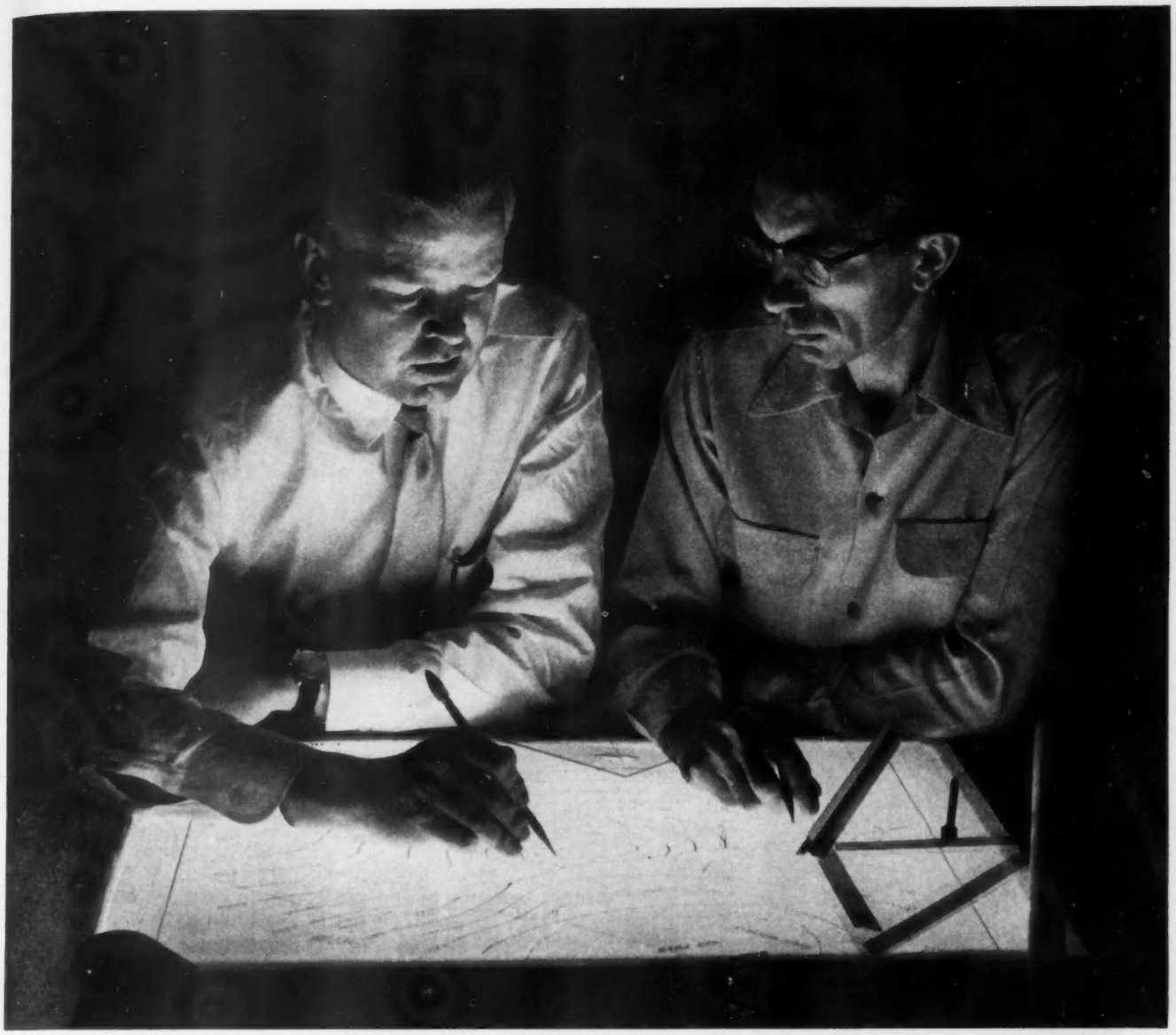
THE LAST FEW YEARS have seen a tremendous increase in the number of marine seismic parties. This great increase and consequent competition has led to wide-spread improvements in field technique, instruments and interpretation. As a result of this, in combination with new and more accurate positioning methods, it is now possible to carry on marine seismic surveys at one-third the cost per unit area as compared to land seismic surveys. It is also possible to survey very large areas in a short time. Surveying along grid lines placed at intervals of three miles, it is not unusual for a modern marine seismic reflection crew to survey seven hundred and fifty to eight hundred miles of traverse per month.

Among the improvements that have resulted in increased efficiency and accuracy of results of marine seismic surveys are the following:

Floating Seismic Cables. The introduction of floating seismic cables presents a great improvement over the formerly used cables which were dragged along the sea floor. A floating cable can be handled more readily than a bottom drag cable and, because of greatly lessened resistance, minimizes wear and damage to the detectors.

The development of the floating cable is chiefly due to recent discoveries in the field of plastics. Some of the most modern floating seismic cables consist of a series of electrical conductors and a steel strain cable surrounded by expanded cellular polyethylene.

New Seismic Detectors. Considerable improvements have been made in detector design for use with the



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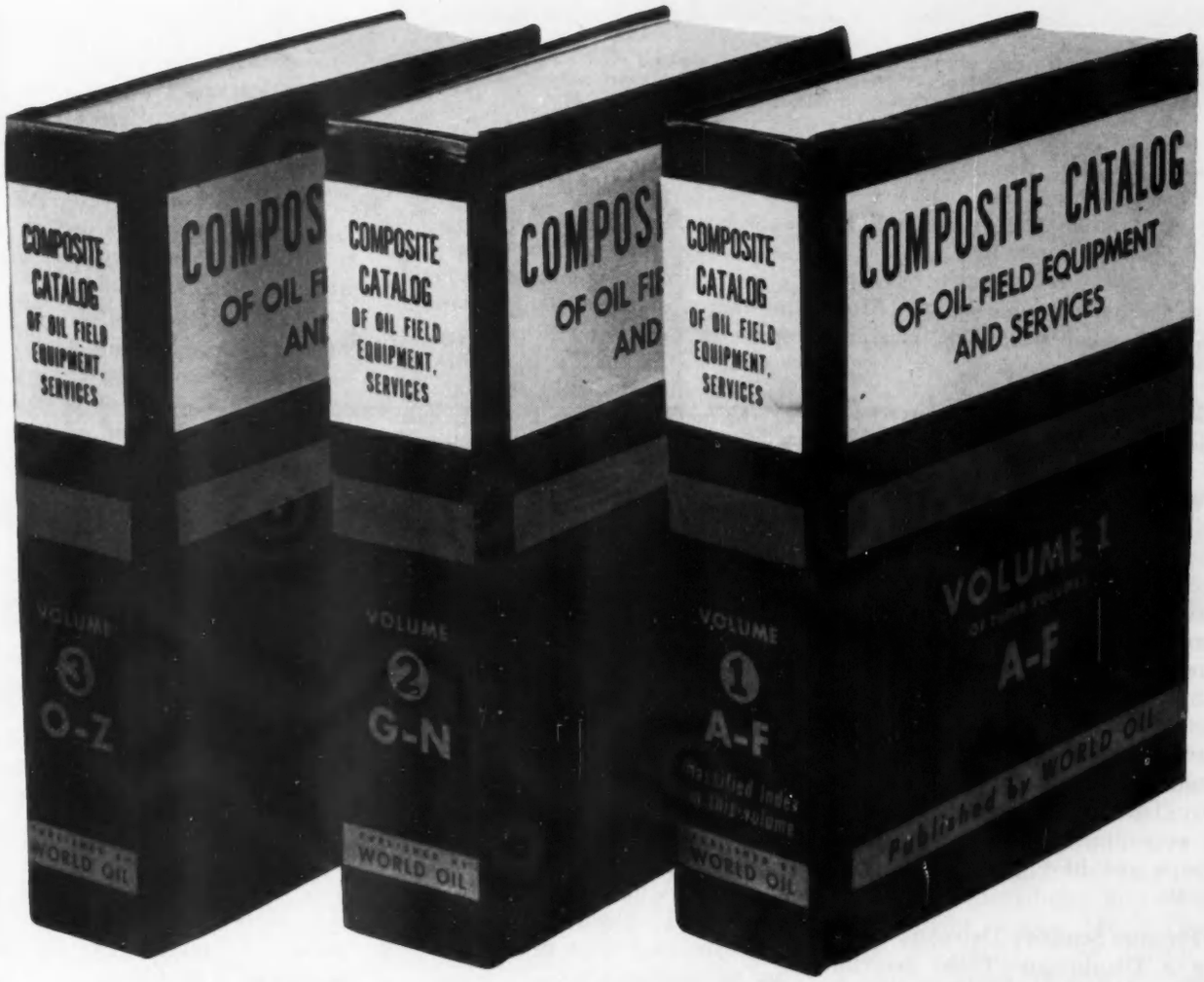

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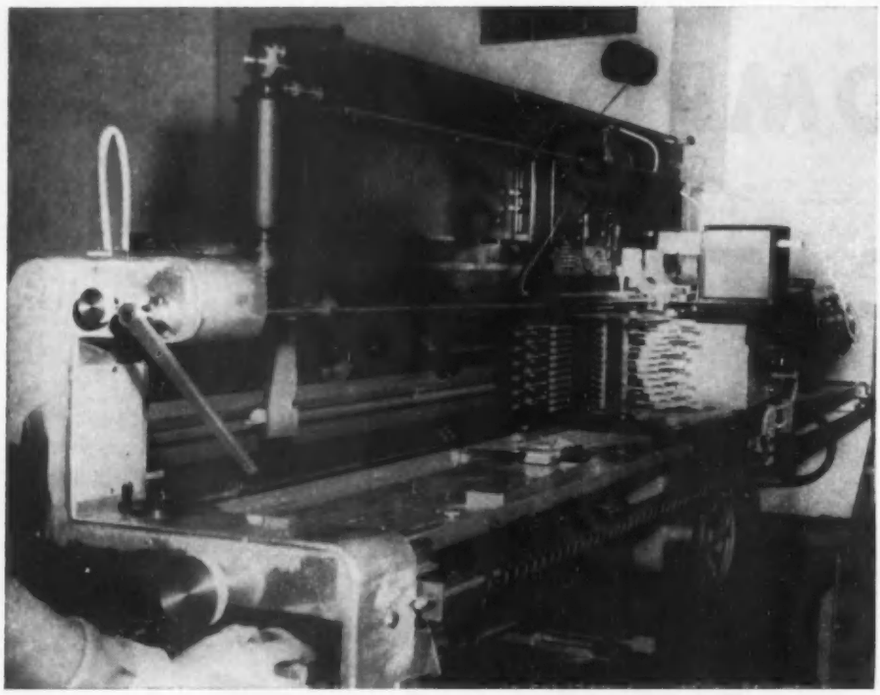


A cross-section plotter. This machine is used to make a continuous seismic record section from the original seismograms and allows correction for differential elevation of the hydrophones and natural movement due to a spread symmetry.

modern floating cables. Most of these modern detectors are sensitive to pressure, rather than to motion. This eliminates background noise due to water waves and improves the discrimination of seismic energy. Modern hydrophones can be classified into the following types:

Magnetostrictive Detectors—Developed from the sonar detectors used in anti-submarine warfare in World War II,, they consist essentially of a magnetic alloy tube surrounded by a toroid coil. Any deformation of the thin walled tube induces a current between the ends of the coil. This current is proportional to the pressure applied to the tube.

Such a detector is insensitive to motion but quite sensitive to a pressure variation in the medium surrounding the magnetrostrictive device. These detectors are used singly or as multiples in series or parallel groups and have yielded very good results.

Pressure Sensitive Detectors Utilizing a Diaphragm—These detectors are essentially normal geophones which are contained in a sealed chamber. One wall of the chamber consists of a highly flexible metal diaphragm coupled mechanically to the moving coil of the geophone. Any variation in pressure on the diaphragm causes motion of the coil of the geophone, thus creating a current between the ends of the coil. This detector is commonly used in pairs. These pairs are connected in series, in such a manner that pressure increase or decrease will cause current vectors in the outputs of the two individual units to add. Lateral motion of the whole device, however, causing one diaphragm to move inward and the other outward, produces a vectorial subtraction of the output. This minimizes stray signals due to motion of the hydrophone and cable.

Crystal Hydrophones—Crystal hydrophones are based on the principle of piezo-electricity, in that a current is generated between opposite faces of a ceramic crystal or tube when it is subjected to pressure. This type hydrophone has an extremely linear output, and is used for scientific measurements. The U.S. Navy has employed crystal hydrophones for many years in their electronic tests.

Crystal hydrophones are generally employed in groups of five or more per seismogram trace.

Velocity Geophones—Adaptions of normal geophones such as are used on land, they are sealed in waterproof cases and swung in gimbals to maintain a vertical orientation within the case, and are used chiefly in bottom-drag cables. Hence, they are not used as much at present as formerly, and they find their chief application in special techniques such as that of outlining a salt dome under the continental shelf. Since this is done by means of recently developed special refraction techniques, bottom-drag cables are used, utilizing special low frequency geophones.

Interpretation. Perhaps the greatest strides of progress in marine geophysics have been in the field of interpretation. This field has always been a highly critical one, particularly for offshore seismic surveys. The large volume of data which accumulates in a short time in marine surveying further adds to the acuteness of the problem. New methods of interpretation fall into two categories; first is recording the seismic data; secondly, analysis and presentation of these data, including automatic reduction.

New Methods of Recording—These may involve the use of magnetic recorders which allow the selection of optimum filters and playback as well as permitting a compositing of seismic records. Alternately, recording by special cameras permits reduction and correction of data by optical means.

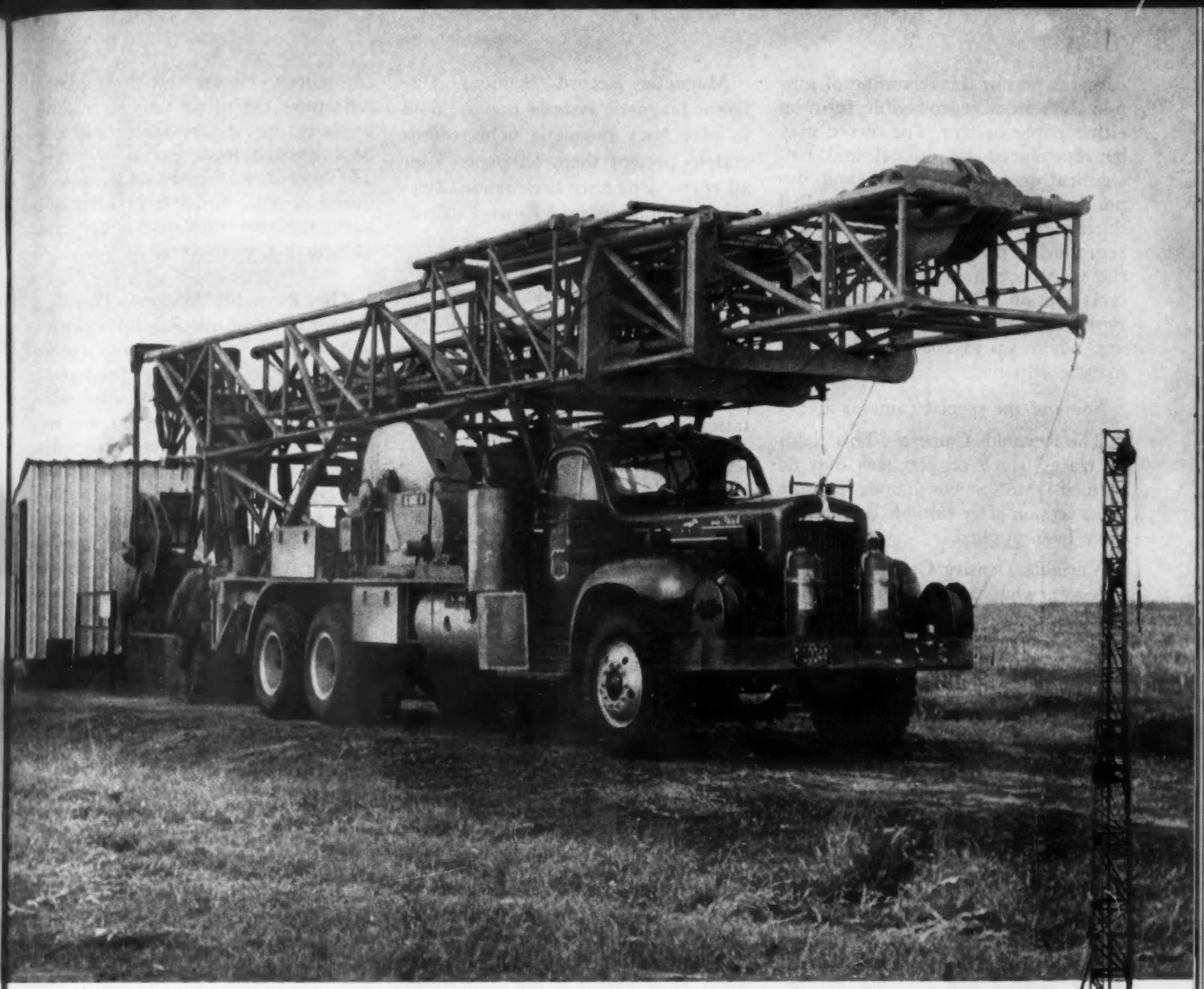
Magnetic Recorders—A great variety of magnetic recording devices have been recently introduced in the seismic industry. Some of these are especially suitable for offshore seismic work because of the flexibility of further processing permitted by a magnetic record. A magnetic record may be played back with a great number of different filter settings, it may be used in a complicated electronic computing machine which makes the necessary static and dynamic corrections and ultimately in a seismic cross section machine.

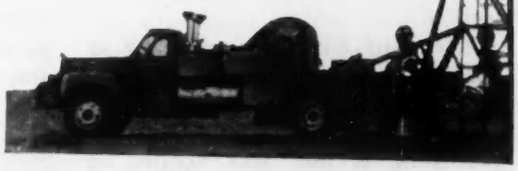
Below are a few examples of magnetic recorders under consideration by the offshore seismic industry:

The Magnetic Tape Recorder—The magnetic recorder utilizes a magnetic band permitting up to seven seconds of seismic recording. Incorporated are facilities for compositing of records in the field.

The Magne Disc—A magnetic recorder employing a plastic disc permitting the recording of up to 50 traces of five seconds duration at one time.

Special Cameras—These special





New "all-in-one" well-servicing unit makes headlines in the oil field

From field operating reports comes news of the most advanced design in well-servicing units.

Phillips Petroleum has put together a rig that has large capacity, mobility, and ease of operation combined in a single compact unit. A 66-foot tubular steel derrick of 100,000 pounds capacity, a hydraulic pump capable of developing pressures up to the 2,000 psi necessary to raise and lower the derrick, and a single 37-inch drum winch that handles up to 6,500 feet of 2⅜" tubing or 7,200 feet of sucker rod —all operated by a 3-man crew— have been mounted on a Mack B-62SX chassis for heavy-duty operation in the oil fields.

The Mack B-62SX has power steering, air brakes, and a 10-speed transmission to meet any oil-field condition. For extra stability it is equipped with a safety brake requiring 75 pounds of air before the truck can be moved. The Mack engine operates on liquified petroleum gas with a 9.3-to-1 compression ratio, and has plenty of dependable power to operate the hydraulic pump, thereby saving the weight, space, and cost of an extra powerplant.

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cameras permit the recording of seismic data in a reproducible form on either paper or film. The record may be reproduced by optical and mechanical means and static and dynamic corrections may be applied during reproduction. Some of the reproducing processes lead directly to the construction of a seismic record cross section. This is of considerable importance in marine seismic surveying, where up to 200 records a day may be obtained.

Some of the special cameras are:

The Reynolds Camera—This yields 12 traces which on playback may be formed into a continuous seismic cross section after suitable corrections have been applied.

Variable Density Cameras—These are somewhat analogous to motion picture sound tracks, in that the individual reflections are reproduced in the form of half-tones on photographic film. This variable density record may be reproduced in the form of a seismic record cross section.

Variable Area Cameras—These represent a medium between the variable density cameras and the Reynolds camera. They are actually somewhat closer to the Reynolds type camera in that each reflection appears as a dark triangle beneath the sine wave form. These, like both the above systems can be used to construct a corrected seismic record section.

The chief advantage of many of the above systems when applied to marine seismic surveying is that they allow automatic or semi-automatic processing of the large volume of data resulting from offshore seismograph work.

New Methods of Data Processing—These can be divided into methods based on magnetic recording and into methods based on special cameras.

A Special Seismic Process—This is a process based on interpretation of the disc magnetic records. It involves correction of each trace and re-recording of the corrected trace on a second magnetic disc. All computations are made by a digital electronic computer.

The ultimate goal of the process is the electronic picking of coincident reflection events and presentation on a cross section.

Magnetic Record Sections—Different magnetic systems may be used to play back magnetic field records and to present them on paper after all corrections have been made. Electronic computers may be used to correct for steep dip areas and to emphasize stratigraphic traps and pinch out. The individual corrected records are subsequently combined by hand to make continuous record cross sections. The process is somewhat slow, but lends itself very well for presentation of geophysical data to management and geologists.

Data Processing Based on Special Cameras—The methods of data processing based on special cameras are perhaps more applicable to the requirements of the marine geophysical industry than any others. They have the advantage of rapid processing of the field data and presentation of these data in the form of a record cross section. Such a record cross section enables the interpreter to scan rapidly the reflected events in order to draw phantom horizons. Stratigraphic pinch-outs, dip reversals and faults can also be seen easily and rapidly on these record sections.

The record section also minimizes the need for review of the original records in areas of poor to questionable seismic reflections. It is in those areas especially that use of a record section improves the quality of interpretation, as even small, short, partial reflections may be analyzed and added to form a structural picture.

The chief data processing systems based on special cameras and yielding such record sections are the following:

The Variable Density System—This system uses the variable density records described above. These records are played back in a machine which introduces static and dynamic corrections trace by trace. Each trace is printed on a continuous sheet of film which presents after development a complete record cross section. It is the unique characteristic of the variable density type record that reflections are actually picked automatically. Dark lines appear on the final print where a reflection occurs and these persist for as many traces or seismic records as the reflection is continuous. Phases and short partial reflections extending only over three to six traces are also visible and may be correlated from record to record. The record section is somewhat reduced in scale and interpolation of a particular reflection time is only possible to five milliseconds.

The Reynolds System—This is a system based on the Reynolds camera and employs the Reynolds plotting machine. This machine prepares a continuous cross section making static and dynamic corrections for one record at a time. In this respect it varies from the other systems which allow for corrections one trace at a time. This makes for a much faster operation and higher production capacity making it particularly suitable for the rapid production necessary in marine seismic surveying. The Reynolds cross section has the same size as the original record and can therefore be timed with the same accuracy. Individual reflections may be followed for many shot points and in the areas of questionable to poor record quality partial reflections may be correlated to form a phantom horizon.

Interpretation of stratigraphic pinch-outs, faults, and minor dip reversals are particularly easy on this type of section.

Combination Systems—The combination systems are the most recent development of the methods of data processing. Many of them are still in development and not ready for practical consideration. One system however deserves mention. This is a type of cross section camera where a galvanometer block is substituted for a film or seismic record. This galvanometer block is actuated by a magnetic tape record giving all of the advantages of magnetic recording. All static and dynamic corrections are introduced by suitable apparatus. Corrections are made for a whole record at a time, instead of trace by trace, making for high speed production. Such a combination system combines the advantages of interpretation of a continuous record cross section with the flexibility of filtering and the possibility of record composing given by magnetic recording. This seems to point a definite trend which we may expect to see further explored in the future. —**The End**

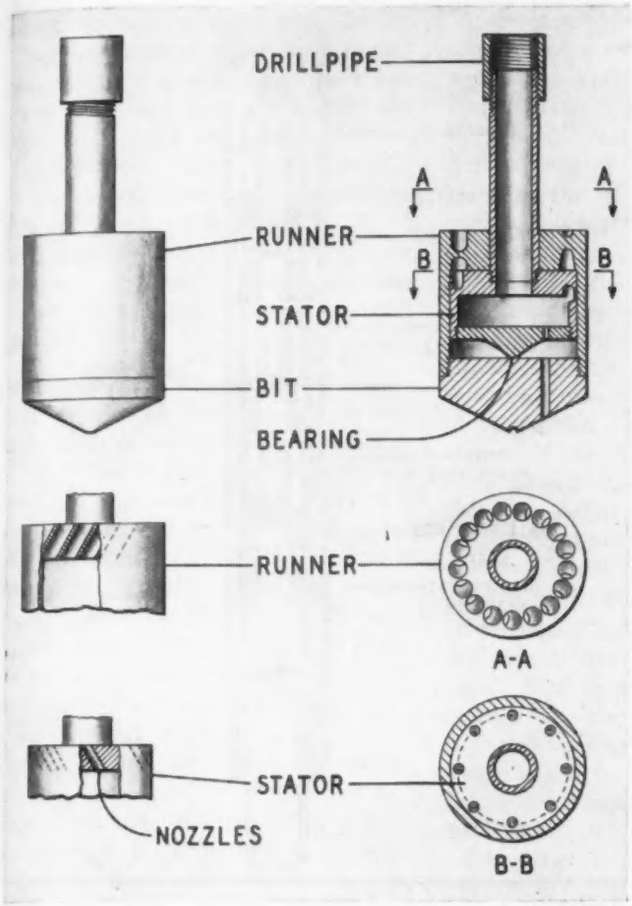

FIGURE 1—This is the basic concept of the primary element of the turbo drill as designed by Dr. C. G. Cross in 1873.

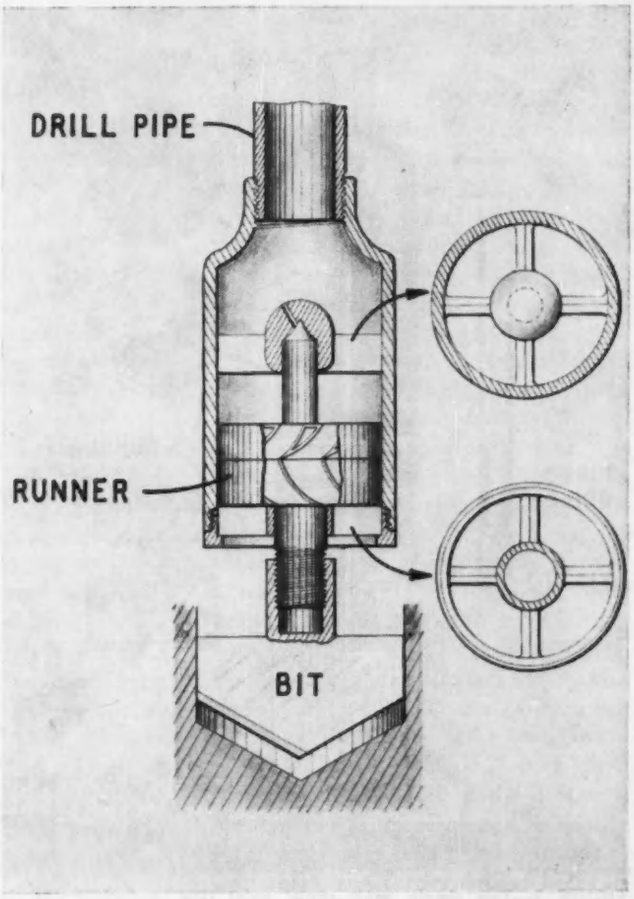

FIGURE 2—This is an improvement of the Cross turbo drill design as undertaken by M. C. Baker in 1884.

Special Turbodrill Report

Turbodrill Development—Past and Present

A roundup of turbodrill developments from 1873 to the present with reported results compared with modern rotary methods.

By J. H. THACHER, California Research Corporation
and
W. R. POSTLEWAITE, The Standard Oil Company of California

ALTHOUGH MUCH OF THE performance data on turbodrills are based on official reports from Russia, a recent and comprehensive French engineer's appraisal shows that basically the new heavy duty turbodrills have ample power to exceed the performance of the rotary in medium or hard rock drilling. The mechanical developments leading up to the present day turbodrill are noted and the steps needed to demonstrate the economic possibilities of the new tool in the U. S. are outlined.

The increasing difficulty in finding large new sources of domestic petroleum and the higher cost per barrel of such oil, are further pressures compelling a critical review of our present methods of drilling and to consider their improvement.

Drilling Research. Speaking from a research viewpoint; to reduce drilling costs materially we must continue not only to improve present methods, but to seek new and better methods of penetrating and removing rock. Much further research is needed to extend our knowledge of the basic physics and mechanics of drilling. More should be understood about the process of rock failure beneath the bit, and what physical properties of the rock are most important in this process. The effect of overburden pressure and the mud column pressure on the bit's ability to penetrate should be known. The stress distribution in the rock at the cutting face, and the effect of this stress distribution on chip formation should also be understood.

In short, while we have learned something about the basic principles important in drilling through rock, much remains to be known. The end result of this search might well be an entirely new process of rock penetration. By "new" is meant something like drilling with the energy of sound, or with thermal energy, or with any type of energy used in a manner quite

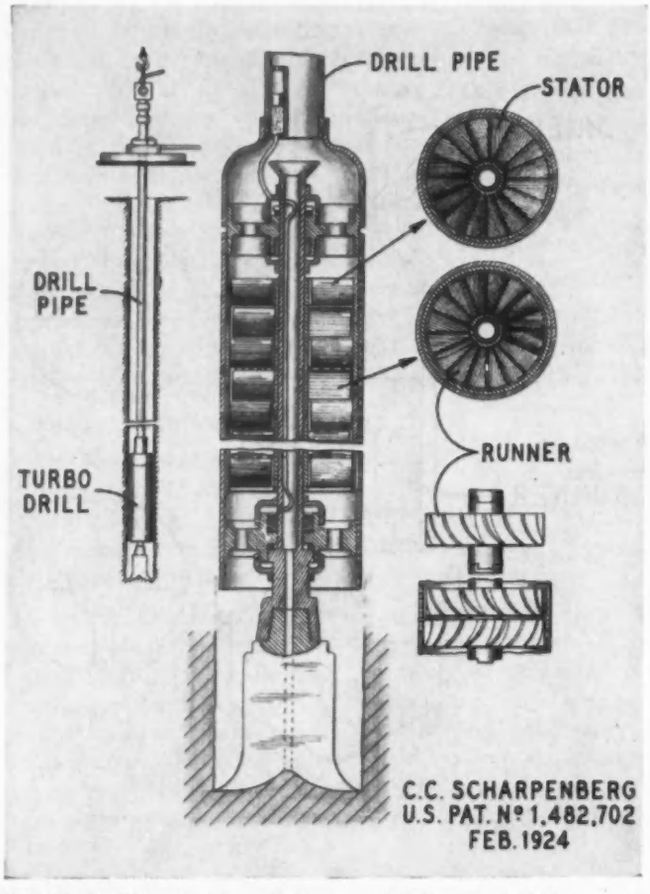

FIGURE 3—This simple, multi-stage, axial flow, turbodrill was developed by C. C. Scharpenberg of Standard Oil Company of California and patented in 1924.

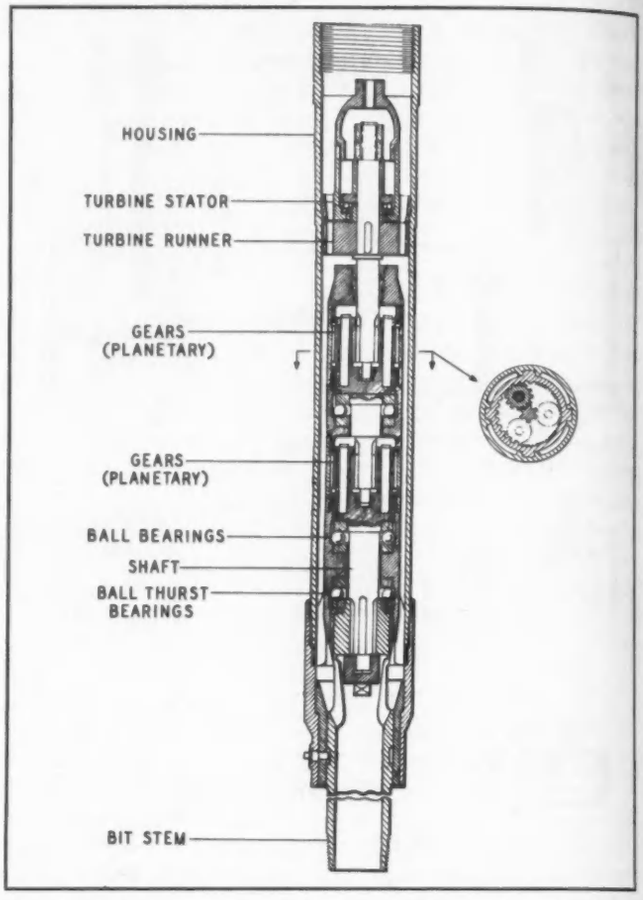

FIGURE 4—Early Russian, single-stage, high speed mud turbine, patented September 15, 1924.

different from our present direct application of mechanical energy.

An entirely new process could take many years to develop. In the meantime, there are several different schemes of applying mechanical energy to the bottom of the hole that are more apt to result earlier in a tool better suited to our field use. Three of these are currently undergoing extensive research and development; the first two are new percussion tools, and the other is the turbodrill. It is pertinent to note that all of these place the power unit at the bottom of the hole.

1. Magnetostrictive drill by Drilling Research, Inc. The drill operates from alternating electric current in a manner basically different from the usual electric motor or solenoid. Aside from this unique motor, the main point of the DRI method is that the bit can be made to strike the rock at several hundred cycles per second.

2. Sonic drill by Borg Warner. This, like the DRI drill, is a vibratory percussion drill. The power is transmitted to the 150 to 200 hp downhole turbo motor by the mud stream, rather than by electricity, and the frequency of mechanical vibration is much less.

3. Turbodrill. The turbodrill, which is in a more advanced state of development, will be discussed.

What is the Turbodrill? If the conventional rotary drill is considered to be approaching the limit of its possibilities, as some informed people have reason to think, the present day turbodrill may now be described as the promising economic substitute for the rotary, particularly when drilling in rock below 6000 to 7000 feet. On this basis, the turbodrill is evidently on the threshold of widespread use in the medium and hard rock formations where it is most applicable and effective. The turbodrill may be defined as a drilling process which has the important characteristic of maintaining its power available at the bit regardless of the hole depth. This is not true of the rotary which rapidly loses much of its power due to friction of the rotating pipe in the hole that, at depths below about 6000 feet, it has sacrificed most of the table's input in drag on the mud and on the hole wall. At 10,000 feet, it has inadequate power and speed at the bit to satisfy optimum drilling conditions. Quoting from a French article—"It is decidedly an impasse where such a relatively small tool (weighing about 200 pounds) is turned too slowly in a system that must expend as much as 90 percent of the power applied to merely rotate a 'tool holder' weighing over a hundred tons."

The modern turbodrill has few basic parts. These include an external cylindrical and nonrotating body, a central shaft that is guided by rubber thrust and radial bearings, and which carries the bit mounted directly on the bottom end, and finally the 80 to 100 turbine stages. Each of these stages is composed of a fixed stator solidly mounted in the main body, and having blades which direct the fluid toward similar curved blades of the rotor element mounted on the shaft. The mud, in flowing rapidly downward through the turbine blading, imparts reaction torques on the blades of each runner to drive the unit. The mud also lubricates and cools the various bearings. The cumulative effect of the torque reactions from all the stages of the mud tur-

bine develop the power to drive the bit.

Unlike previous experimental turbos, the new models have an abundance of power and torque, and are reported to have practical durability. The horsepower now ranges from 300 or 450 hp, bit speeds are from 500 to 900 rpm with bit loads of 20 to 35 tons, and the running torques are on the order of 2000 to 3000 lb.-ft. This is enough to turn effectively almost any bit.

The Important Beginning. The earliest record of any liquid-powered turbodrill for boring wells credits Dr. C. G. Cross of Chicago, who in 1873 disclosed the basic concept of the primary element of the turbodrill in his U. S. Patent 142,992. His design is shown in Figure 1. It was this single-stage type of turbine, with its very high nozzle velocity, that was used 51 years later by the Russians in their first turbo design in 1924.

In 1884, M. C. Baker, in the territory of Dakota, undertook to improve on the Cross turbodrill, and the design illustrated in Figure 2 was then shown in a U. S. patent. It is interesting to note that the advantages originally cited by both these early U. S. pioneers are still valid. Mr. Cross correctly pointed out the serious limitations on the drilling depths of the rotary (diamond drill) of that time, and the reason for proposing the new bottom hole turbodrill principle. His patent explains that although the rotary diamond drills of that period had been used with considerable success to a depth of 300 feet, the tube to which the bit was connected,—"was liable, because of the great strain upon it and its great length, to become bent, twisted, and broken." He further states:

> "The object of my invention is to drive the drill at the bottom of the well without turning the rod or tube with which the drill head is connected, thus obviating the difficulty mentioned, and rendering it practicable to drive a drill at the bottom of a well of great depth."

Thus, the fundamental use of the turbodrill for deeper drilling, and the inherent and still real advantage over the rotary, was clearly established 83 years ago.

In 1901, with the advent of the rotary well drilling method at Spindletop near Beaumont, Texas, the rotary drill, together with the percussion cable tool system already widely in use, became the two generally accepted drilling processes. They were the proper economic choice (particularly the rotary) for about the next 50 years because the drilling depths were on the average fairly well suited to the effective working ranges of that equipment.

However, as early as 1922, C. C. Scharpenberg, then chief engineer of the Producing department of Standard Oil Company of California, had the foresight to visualize the possibilities of a turbodrill for the well depths of the future. Furthermore, the limitations of the rotary for deep drilling were already starting to appear. In October of that year he applied for a patent on a simple multi-stage axial flow turbodrill constructed as shown in Figure 3. His patent was issued on February 5, 1924, and the first test drilling was done in 1926 in Elk Hills, Calif. On Sept. 15, 1924, seven months after the Scharpenberg patent was issued, Russian Patent No. 546 was allowed to M. A. Kapelyushnikov, who conceived of a quite different approach to the problem for driving the bit at the bottom end of a stationary drill pipe.

This early Russian turbodrill design employed a single-stage high speed (1800 to 2000 rpm) mud turbine, with a nozzle mud velocity of about 200 fps, and a mud flow rate of 200 to 300 gpm. This turbine was geared down through one to three stages of complex planetary type gearing, running in oil and enclosed in a sealed box to give the low bit speed of 50 to 100 rpm then used in rotary drilling practice. This turbodrill design shown in Figure 4, was of lower power, delivering but 12 to 15 hp at the bit. It is reported to have been used first in Russia in 1925.

By 1930 the usable service run was still limited to but three to four hours on bottom, due to loss of lubricant through the shaft seals which the mud cut out, thus resulting in bearing failures. Scharpenberg's early sealed shaft bearings suffered similar packing failures, but the low mud velocity which has characterized his lower speed turbine gave no erosion problem, whereas the 200 feet per second jet velocity of the Russian design resulted in excessive turbine wear.

Scharpenberg Models. In 1935 the Scharpenberg turbo shaft was fitted with the first rubber radial guide bearings, and the ball thrust bearings at the bottom end were re-designed by the A. O. Smith Corporation and boldly opened up to run directly in the bud without seals; see Figure 5. This model retained the original simple and basic multi-stage turbine arrangement, with the bladed runners mounted directly on the long shaft carrying the rotary bit. The horsepower for a 30-stage, 9-inch size unit was about 92 at the rated speed of 700 rpm, with a flow rate of 550 gpm, and a turbo pressure drop of 580 psi. The maximum fluid velocity then used did not exced about 20 feet per second, so the mud abrasion was minimized.

Five wells were drilled for the Producing department of Standard of California with this experimental equipment by 1941 when the war interrupted the work. In 1950 testing was resumed with the same 9⅝-inch turbo drilling to 3000 feet near Coalinga, Calif. The average penetrating rate was 51 feet per hour, using 4000 to 5000 lb bit load, 5½-inch drill pipe, desanded mud, and bit speeds up to 1200 rpm. However, with the rotary improvements made during the war years, the rotary drilled holes in the immediate vicinity had higher average penetrating rates and, although this turbo developed over 200 hp in this last test, it was concluded that a heavier duty unit was required using multi-step rubber thrust bearings which had been designed earlier in 1945. This design is shown in Figure 6.

The EDCO Drill. Another American turbodrill, developed in 1945 to 1950 by the Engineering Development Company in the Mid-Continent, is shown in Figure 7. This design resembles some of the previous constructions and also employed sealed ball thrust bearings. With 90 turbine stages and a speed of 400 to 500 rpm, this unit was rated at 310 hp, but in five test wells serious wear was experienced with the running parts and the available mud flow rate was not always sufficient. The penetrating rates were about the same as for the conventional rotary rigs in the area.

Russian Designs. During the 10 years prior to 1934 the Russians had experienced very limited success with their turbodrill, even in their shallow drilling. In 1930 the early model Russian turbodrill was tested in the Mid-Continent for The Texas Company and the Magnolia Petroleum Com-

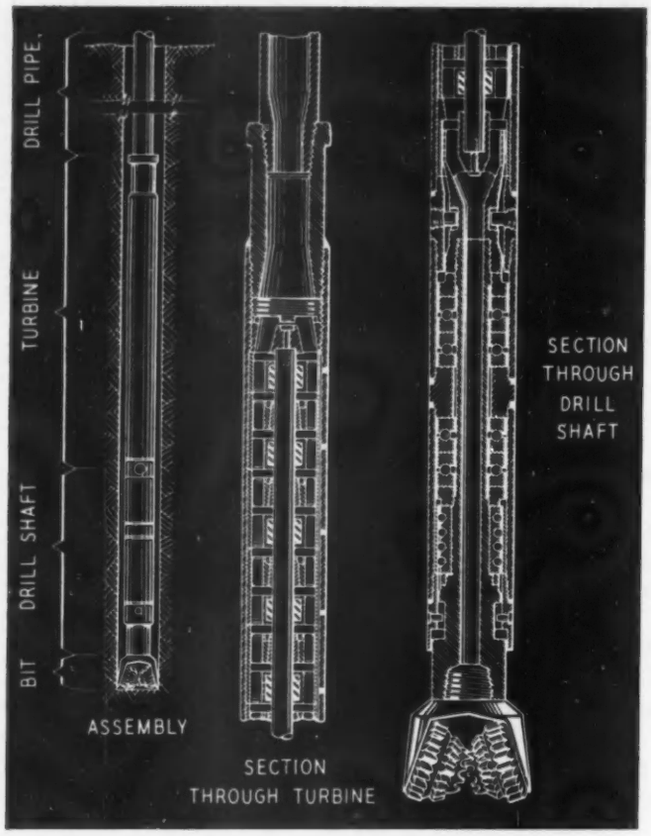

FIGURE 5—The Scharpenberg turbo shaft was fitted with the first rubber radial guide bearings and A. O. Smith Corporation redesigned the ball thrust bearings so that they ran directly in the mud.

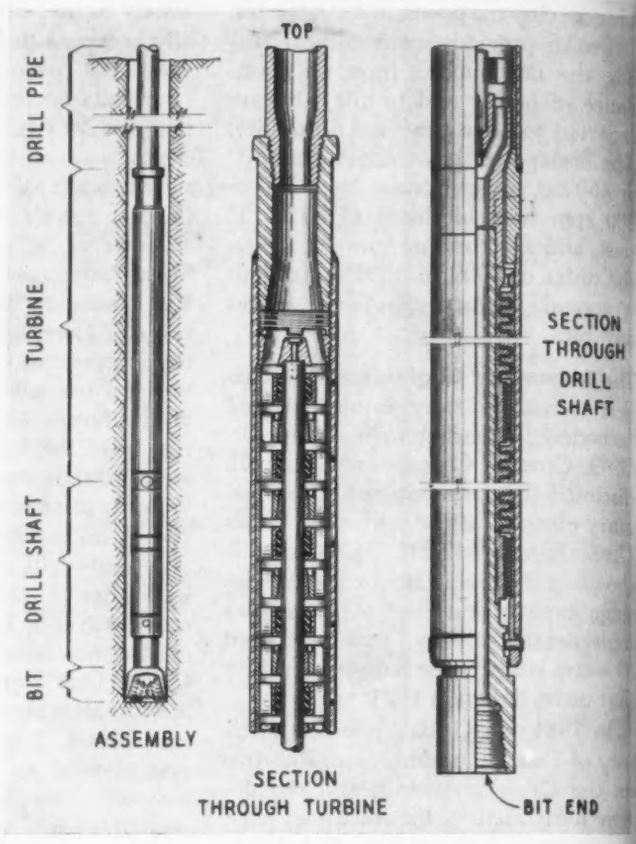

FIGURE 6—The Standard Oil Company of California turbodrill of 1945 with multi-step rubber thrust bearings.

pany. The general lack of success was due in part to their complex turbine gearing which was so difficult to seal off from the drilling fluid. In 1935 they abandoned the single stage, high speed turbine and its sealed gears, and resorted to Scharpenberg's much simpler general arrangement of a multi-stage, axial flow, design with the bit mounted right on the bottom end of the turbine runner shaft. This multi-stage design offers a fundamental advantage since it makes it possible to increase the total pressure drop while retaining a relatively low pressure across each turbine stage. In consequence the life of the turbine has been extended to an acceptable value which now makes possible the economic exploitation of the turbodrill. By 1940 the Russian multi-stage turbodrill looked like Figure 8, in which they still clung to the ball thrust bearings sealed by a stuffing box which persisted in giving unsatisfactory results. The ball thrust bearings lasted but 8 to 10 hours in service, just about as we had previously experienced.

By 1945 their TM14-9¾-inch turbodrill with 96 stages, developed 100 hp, and in 1948 a radical change in bearing design was made. Sliding rubber thrust bearings were substituted for the steel ball bearings. This permitted designing much heavier duty units. In 1950 their present 10-inch turbodrill was evolved. This unit develops up to 450 hp at a bit speed of 790 rpm, with 1030 gpm of mud at 1090 psi, and a torque of about 3000 pound foot. This over-all design is now as shown in Figure 9, and except for the important difference in the thrust bearings, it is remarkably like Scharpenberg's earlier turbodrill of Figure 6. This Russian tool, with its mud jet velocity now reduced to 20 to 30 fps, and with the turbine elements constructed similar to the French design shown in Figure 10, is evidently a practical drilling unit which has been widely used for depths to 13,000 feet and deeper. The deepest turbo drilled hole reported to date in Russia is 16,400 feet.

The French Drill. Recently, after two years of design work, the French company, Establissement Neyrpic, in Grenoble, France, has designed a turbodrill based essentially on the latest Russian developments. This firm has built and tested two 10-inch diameter units. (This size develops about 300 hp at 600 to 800 rpm). They have arranged for manufacture of their turbodrill in Germany. Dresser Industries in the U. S., after completing an arrangement with Neyrpic, are undertaking to test and exploit the tools on this continent. Forty Russian turbodrill assemblies have now been imported, and delivery of a quantity of the Neyrpic units is pending.

This brings us up from Christopher Cross in 1873, to the present heavy-duty turbodrill which now, with millions of feet of hole behind it, is said to account for over 80 percent of the current Russian drilling program.

Thrust Bearings. A vital feature that has contributed greatly to the successful development of a practical turbodrill is the mud-lubricated, multi-disk, rubber thrust bearing as finally perfected by the Russians and illustrated in Figures 6 and 9.

The only practical thrust bearing capable of satisfactorily coping with the turbine's unbalanced hydraulic downward thrust of 30 or more tons, or the upward bit loads of similar magnitude, at shaft speeds of 500 to 900 rpm, is the resilient rubber thrust bearing which cushions the pump

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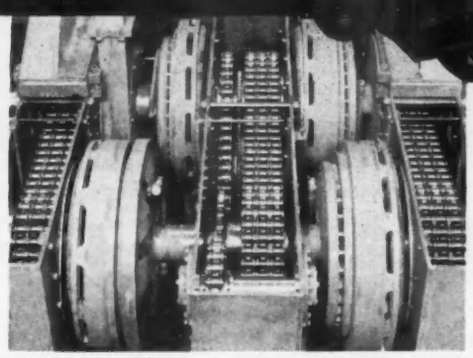

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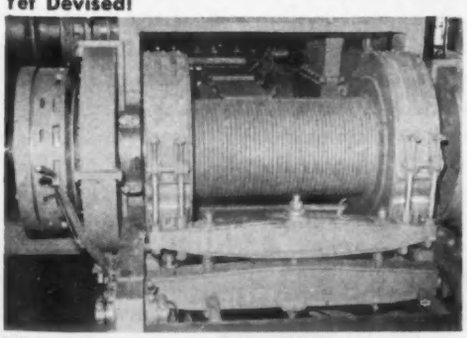

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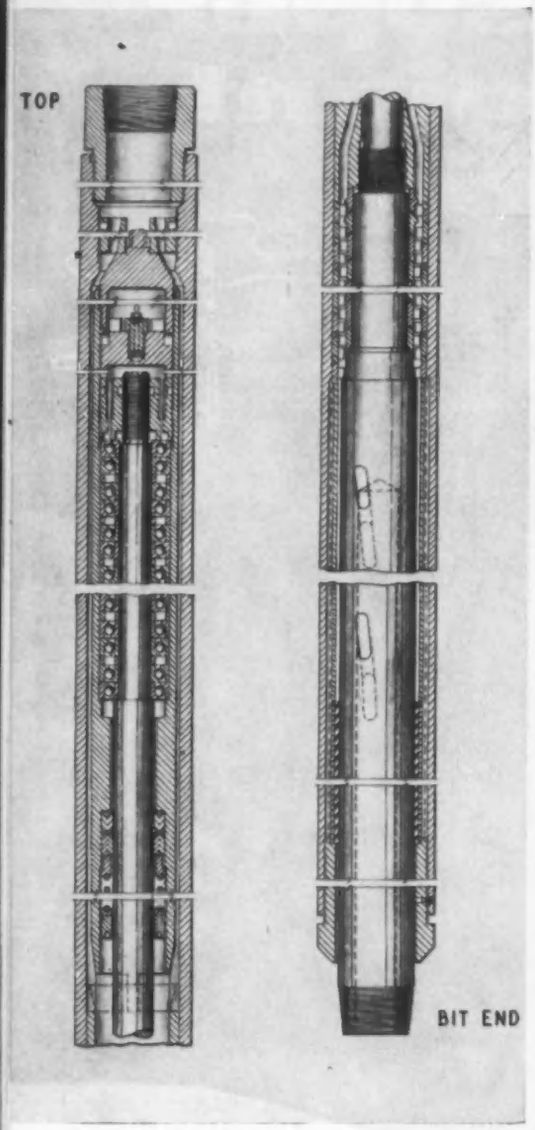

FIGURE 7—This turbodrill designed by the Engineering Development Company between 1945 and 1950 resembled previous designs and employed the sealed ball thrust bearings.

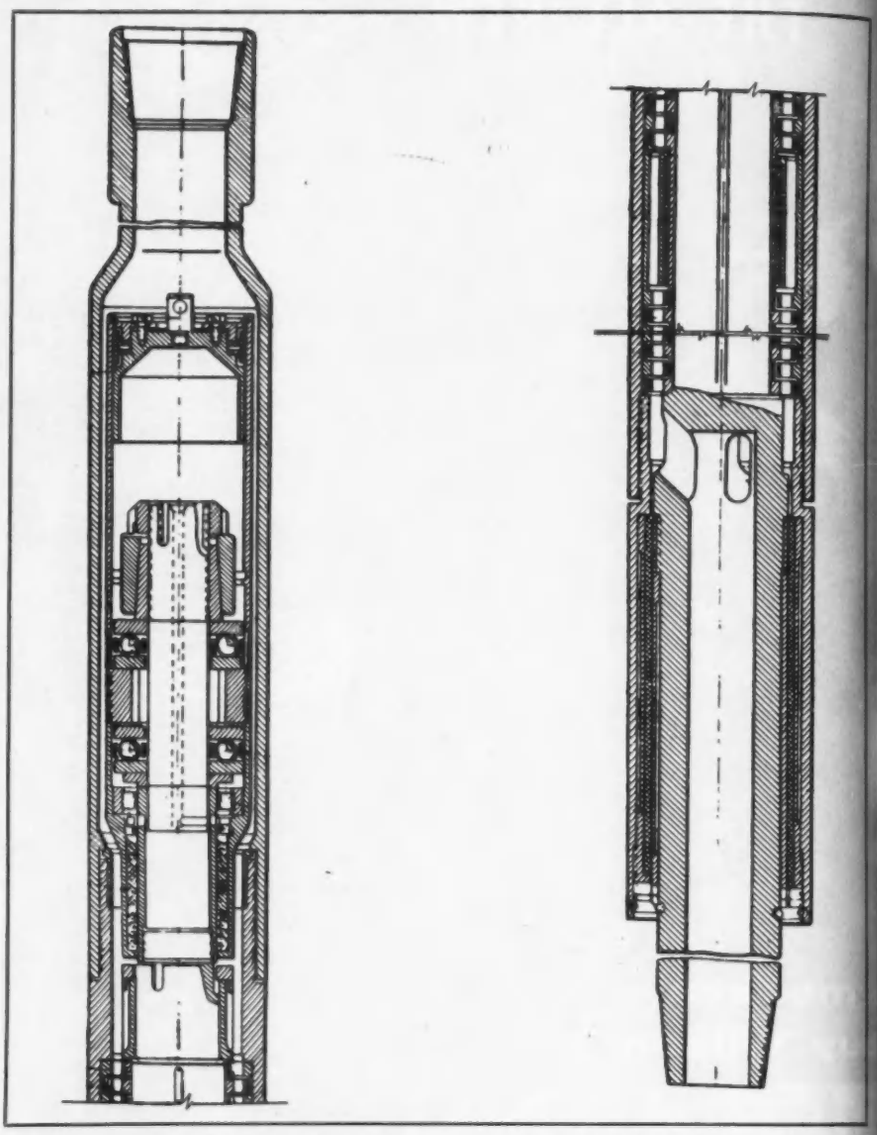

FIGURE 8—This is a cross-section of the Russian turbodrill of 1940. Note the continued use of the sealed ball thrust bearings.

pulsations and the bit reactions. These bearings, with 10 or more disks in series, and unit bearing pressures of over 150 psi, are reported to be remarkably durable with a service life of about 100 to 150 hours. This is primarily due to the elasticity of the rubber. Abrasive particles in the mud simply deform or press into the rubber and roll or are washed out, without injuring it.

However, a certain penalty which may accompany this simple and practical bearing arrangement is its frictional power loss. With clay mud, the bearing friction coefficient is about 0.075. A 9¾-inch turbo, if run with a difference of 10 tons between the downward hydraulic thrust and upward bit load, at a shaft speed of 700 rpm, would incur a significant bearing power loss of about 40 hp. The mud, must obviously cool as well as lubricate this type of bearing. Operating the turbo with water instead of drilling mud reduces the bearing friction by 50 percent, and so releases considerable additional turbine power to be applied to the bit. This materially reduces both turbine and pump maintenance, and also improves the drill's penetrating rate since there is more power for the bit.

The present rubber thrust bearings are reported to be virtually trouble free, particularly when run on water. When worn out, the bearing stack is removed as a unit and replaced. Where the formation permits, maintaining the bit load as close as possible to the heavy downward hydraulic turbo thrust, would balance out or unload the thrust bearings. This is not always practical or desirable from a drilling standpoint. Standard of California has several designs for balancing 50 to 60 percent of the turbo-hydraulic thrust, and it is believed that this device will materially reduce bearing wear, and have use in future turbo drilling.

Why The Turbodrill. As analyzed by W. Tiraspolsky and his co-authors in the copyrighted French publication, "Revue De L'Institut Francais Du Petrole," for August, 1955, the rotary drilling system, supplanted the cable tool system only because the rotary succeeded in transmitting more power to the bit. The results of his analysis, as treated below, shows that a 12-inch diameter 3300-pound cable tool, running at 50 blows per minute, would require the equivalent of about 26 horsepower.

The rotary, on the other hand, may transmit to the 12-inch bit the following horsepower values; (these are

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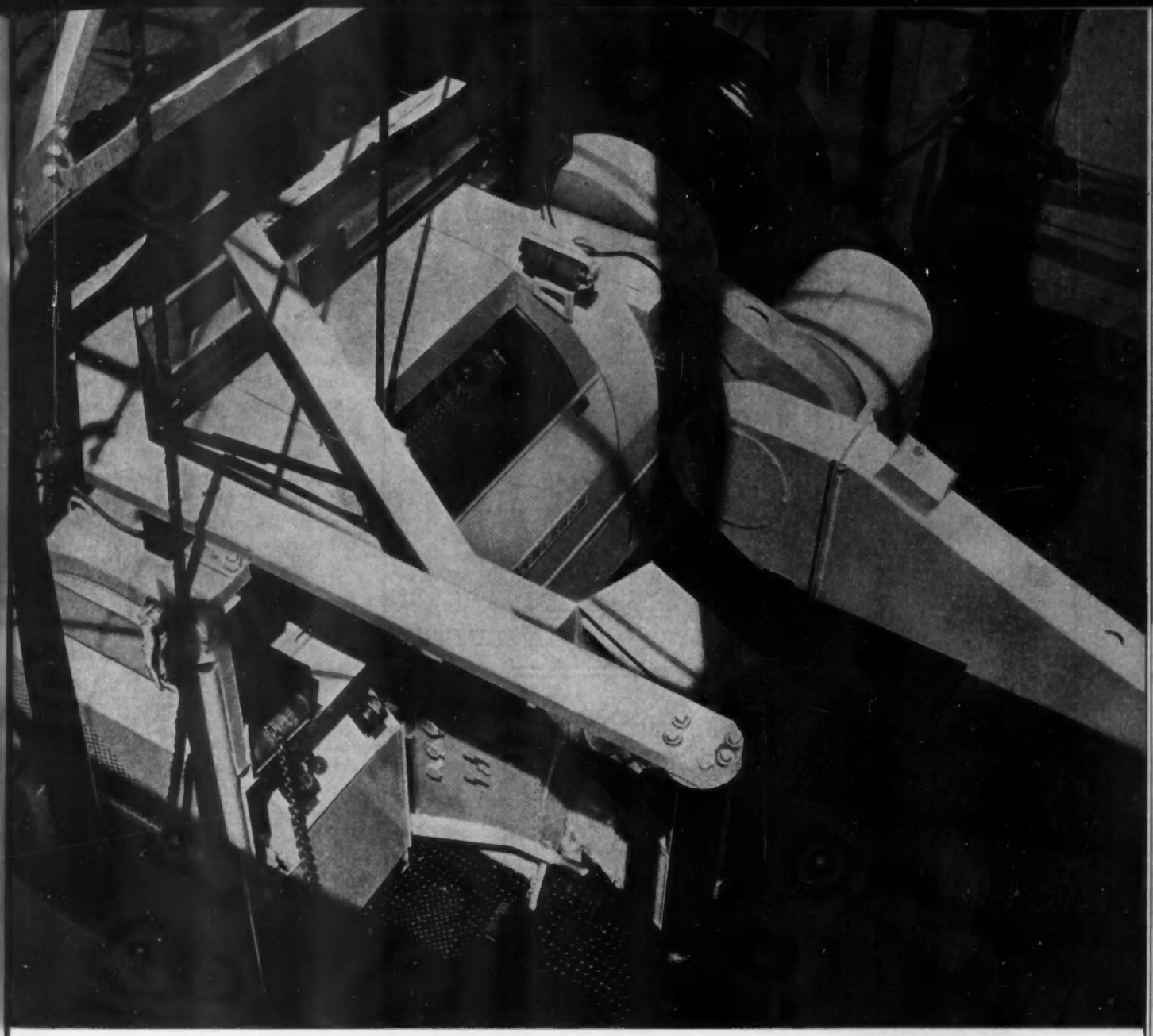

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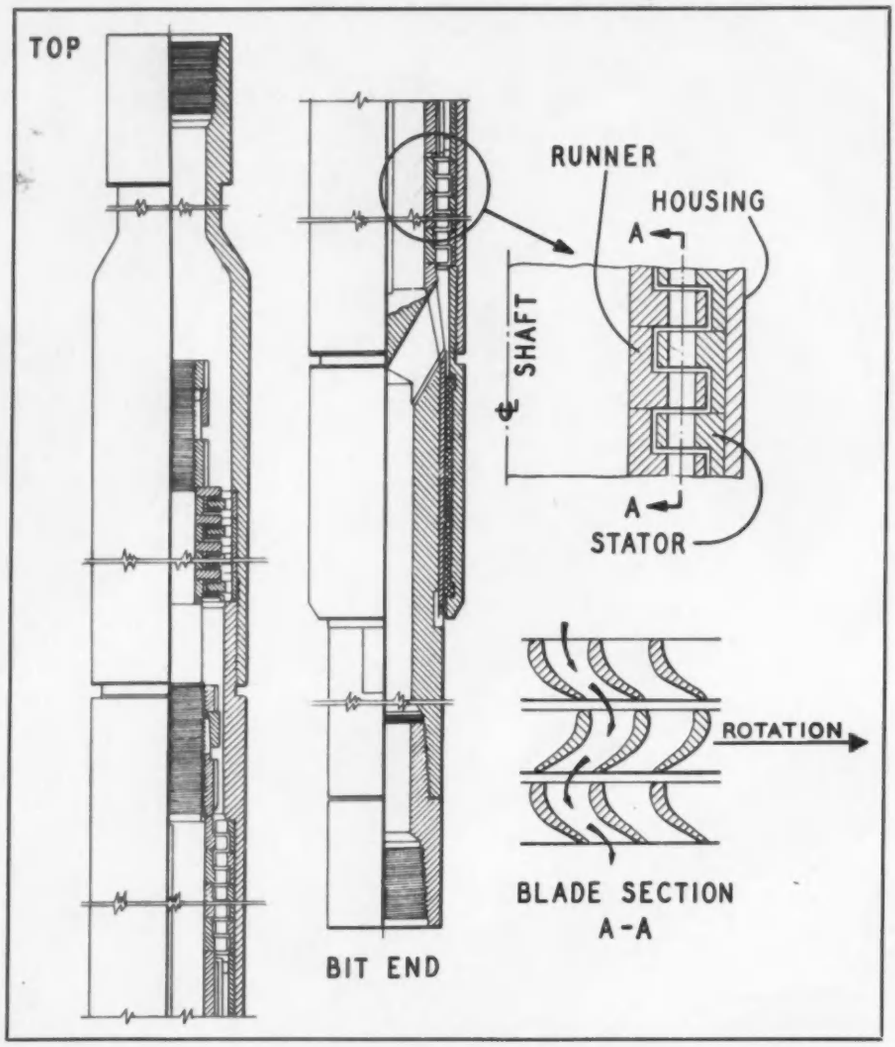
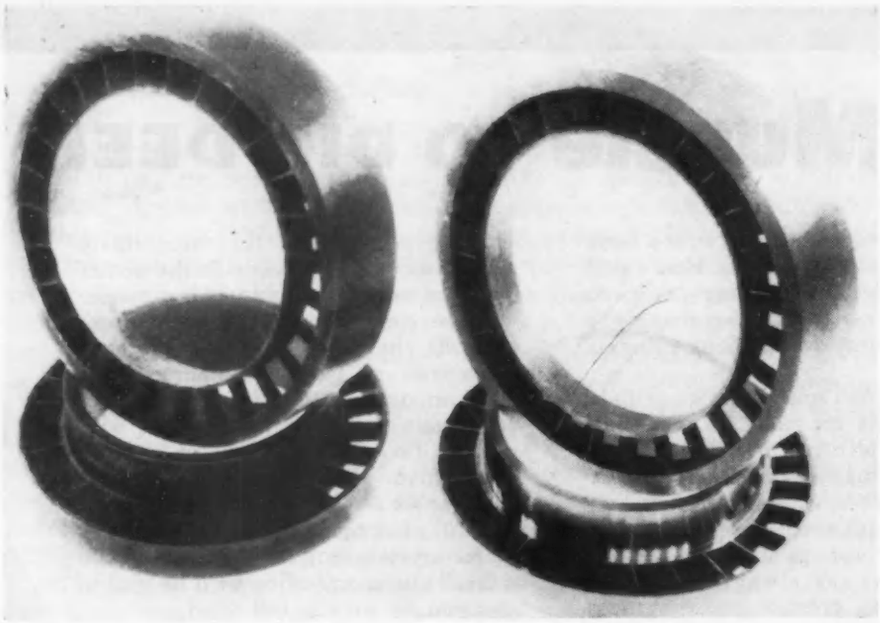


FIGURE 9—The Russian turbodrill T14—9¾-inch is remarkably like the Scharpenberg design except for the sliding rubber thrust bearing.



Courtesy 1955 Institut Francais du Petrole and J. B. Bailiere et Fils, Paris

FIGURE 10—Turbine elements, stator and rotor of the French turbo. The Russian elements are very similar to these.

given as maximums rarely exceeded in practice):

Depth Range—Ft.	HP Available at Bit
0 to 3300	40 to 70
3300 to 6600	30 to 50
6600 to 10,000	20 to 40

The rotary is seen to have about twice the bottom hole power of the cable tool. This difference resulted in a real but modest increase in penetration rate. The rotary also extended the effective working depth well beyond the normal 5000-ft. economic limit of the cable tool. However, the diminishing amount of power available at the bottom of the rotary string leaves much to be desired as the hole deepens, and now the turbodrill offers an effective answer to modern requirements as shown in the following comparison:

	Available HP at 12-in. Diam. Bit
12-inch Cable Tool	26
12-inch Rotary (max. conditions)	70
10-inch Turbodrill	190 to 285 (with 300 maximum)
8-inch Turbodrills connected in tandem	210 to 285 (with 380 maximum)

Thus, according to the French reference cited above, it is seen that turbodrills can deliver three to five times as much power to the bit as the best conditions allow with the rotary. Furthermore, under normal or average drilling conditions, the turbodrill bit attacks the formation with eight or more times the power of the rotary.

With the drill pipe and surface facilities currently in use abroad, about ¼ to ⅓ of the power input to the mud pumps is effectively delivered to the bit by the turbodrill. Thus with a 250 hp turbodrill, 750 to 1000 hp input to the mud pumps is required. The mechanical efficiency of the turbine alone is understood to be on the order of 65 percent for the new Neyrpic designs. The Russians report even higher values, i.e., up to 70 and even 80 percent, although in practice wear probably would reduce the effective value to nearer 60 percent.

The type of formation drilled, affects the relationships between the rotary and the turbo. It is not implied that the turbodrill is a complete cure-all for all drilling. It is primarily a hard rock drill. In many Gulf Coast areas, and some others, it may not equal or keep pace with certain rotary techniques now used with jet bits. Current turbo and rotary drill-

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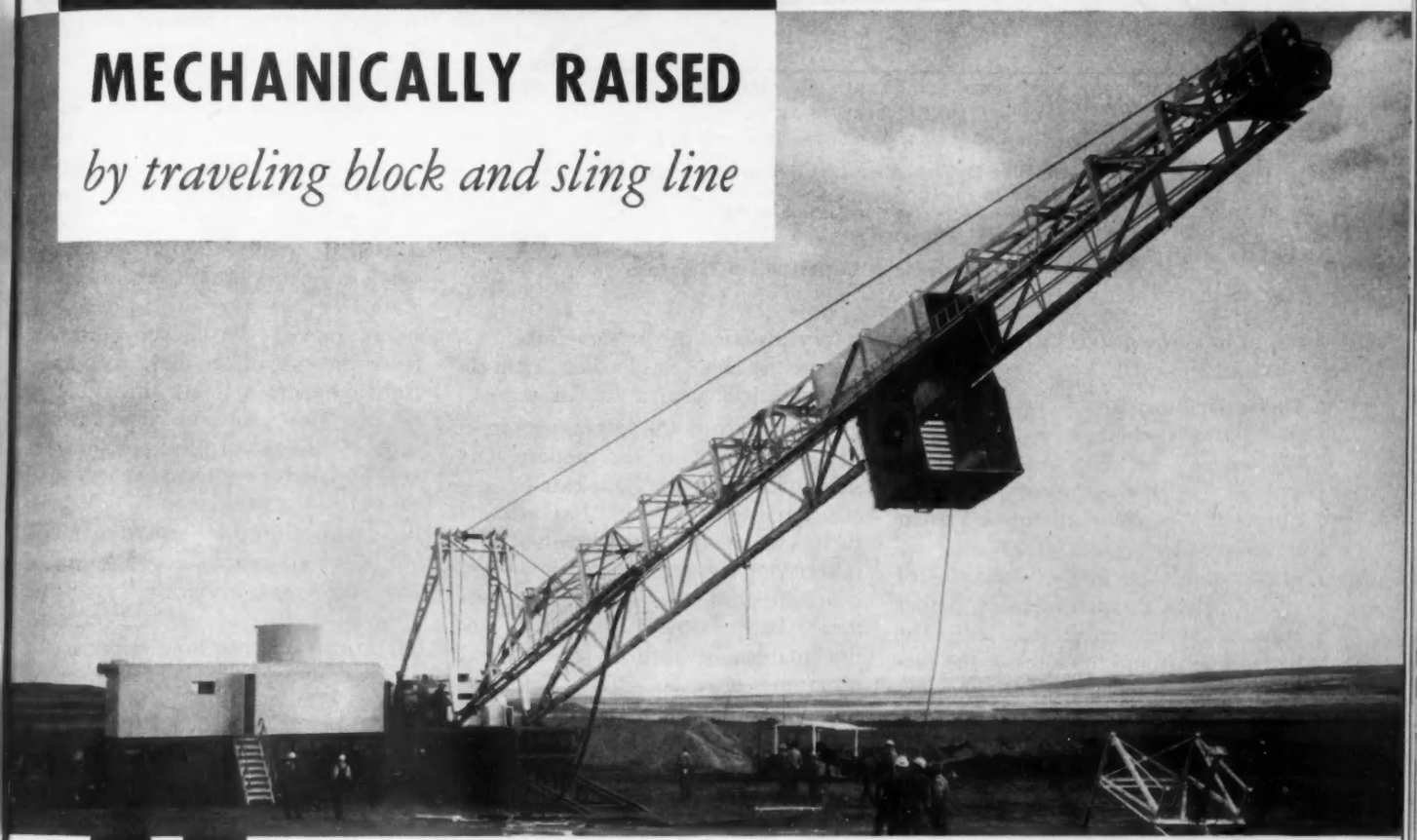

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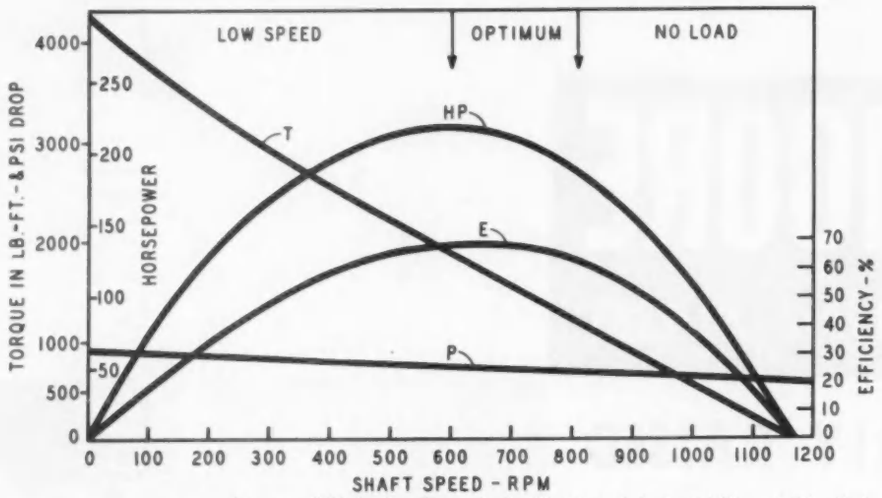


Courtesy 1955 Institut Francais du Pétrole and J. B. Bailliére et Fils, Paris

HP—Effective Delivered Horsepower at the shaft
T —Torque in Lb.-Ft.
P —Pressure Losses in the Turbine in PSI
E —Mechanical Efficiency —%

FIGURE 11—Characteristics of Russian 10-inch Turbodrill.

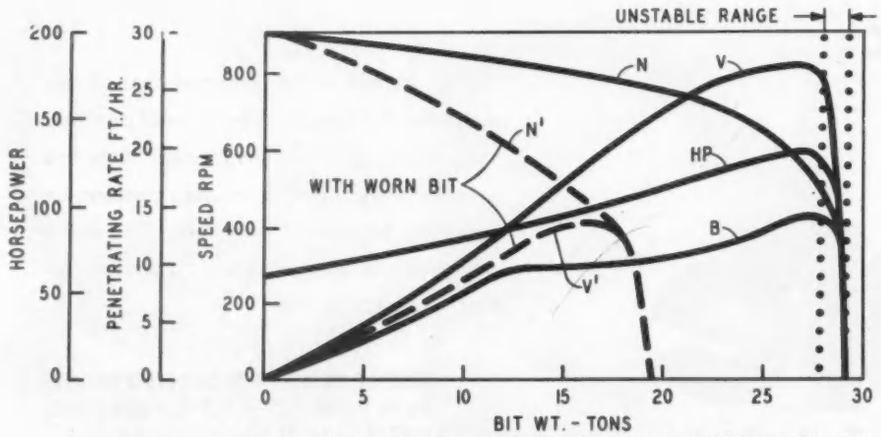
ing in soft formations in Holland also confirms this.

Turbo Drilling Bits. The next question is the problem of bits suited to the turbo's drilling conditions of weight and higher speed. To take proper advantage of the turbo's great bottom hole power, of course, requires that the bits be capable of withstanding the considerably higher running speed combined with the heavy loads that characterize the turbines currently available. Russian experience, as reported for a wide variety of formations, has repeatedly demonstrated that the footage drilled per bit exceeds that of their best rotary practice in the same areas. (A recent test hole in France with the Neyrpic drill gave a similar report.)

As a result of the improvements in the performance of the modern Russian turbodrills, the high rate of penetration, now realized, has affected such a decided reduction in the net on-bottom drilling time, they now conclude that any likely further increase in the penetrating rate would not materially improve the over-all economics of turbodrilling. The hoisting and lowering operations constitute a large percentage of the time, and the important feature is to extend the bit life so as to increase the ratio of the net drilling hours to the total elapsed time.

Our present day rotary bits, developed to suit the slower speed rotary drilling, may not allow the more powerful turbodrill to achieve its optimum performance in hard rock drilling. The French reference cited above, states the present situation substantially as follows:—In contrast to the definite influence exerted by the development of the tri-cone bit on the trend of the rotary design in past years, we now find the turbodrill imposing its characteristics on the tri-cone bit.

Tests by a major tool company on conventional rotary rock bits show that above a certain rpm the rate of penetration does not increase proportionably with rotary speed. Bit wear increased rapidly at high rpm. However, it is very important to appreciate that the new turbos have definitely moved the power bottleneck from the top of the long drill string right down to a point directly above the bit. This is an important advance, and we can take fullest advantage of this by producing bits that can stand up under the heavier duty now available with the modern turbo. Meanwhile, even present tri-cone bits on the turbo are evidently capable of showing improved performance over the rotary as the hole deepens. Oil field equipment manufacturers, in this country, as well as elsewhere, are now devoting particular attention to the new turbo bit problem. If the concerted effort of the bit suppliers is augmented by U. S. users who will obtain the necessary field experience here in drilling with the new turbodrills, a balanced bit design may be expected with the promising incentives involved. Extending the turbodrilling depth on beyond 20,000 feet should then be possible. Although the turbo does promise to be superior to the rotary, particularly at extreme depths, there are many formidable hazards inherent in such deep drilling which would not be altered by the use of the turbodrill.



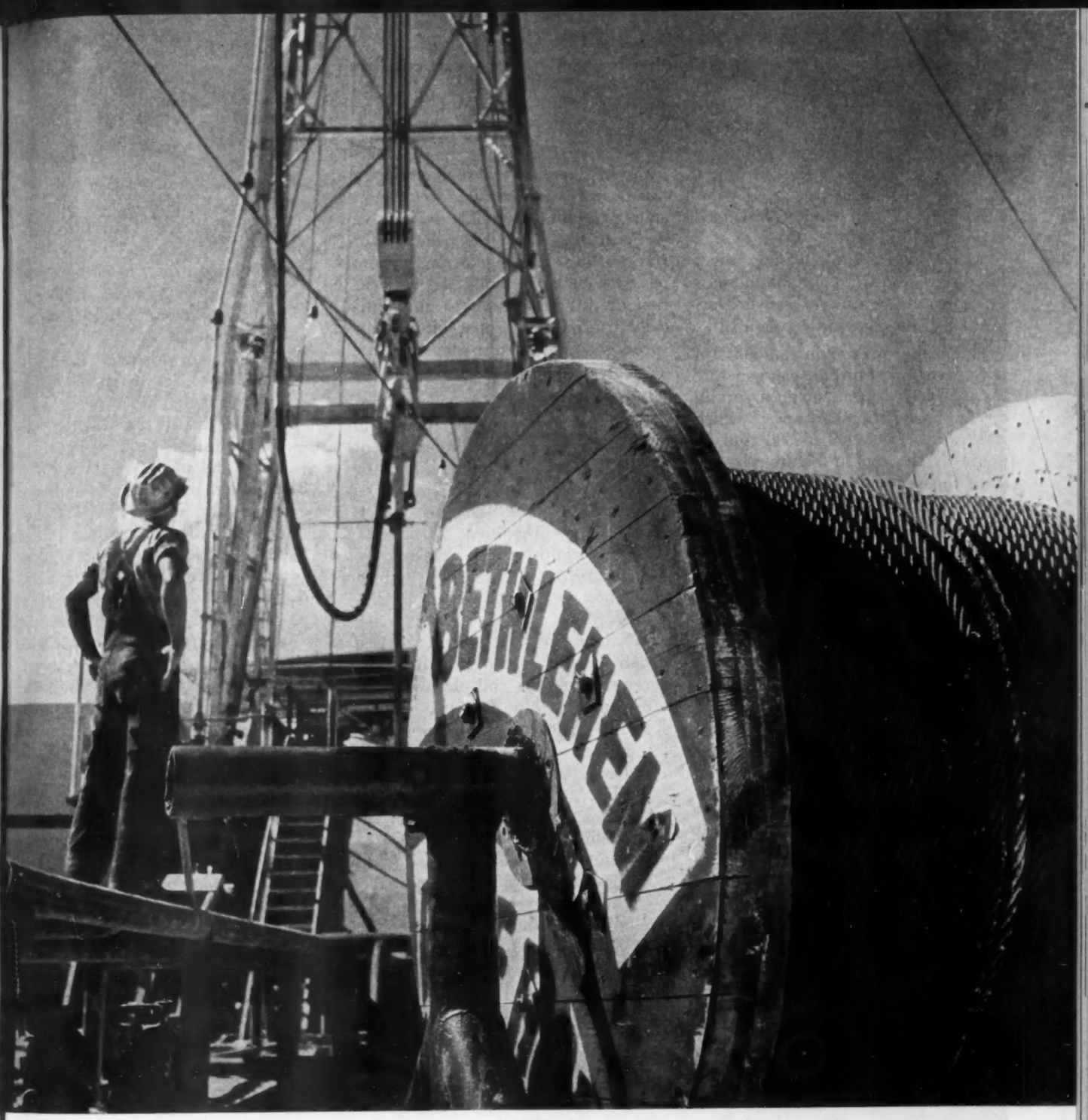
Courtesy 1955 Institut Francais du Pétrole and J. B. Bailliére et Fils, Paris

N —Speed of Rotation
HP—Developed Shaft Horsepower
B —Horsepower Used by Bit
V —Penetrating Rate Ft./Hr.
} With New Bit

FIGURE 12—Experimental Characteristics with 10-inch Russian turbodrill as the bit loadings are progressively increased from peak penetrating rate, into the zone of speed instability, and finally into a complete stall.

Using the Turbodrill. There are several characteristics of the turbodrill that may be pointed out in connection with its proper application and performance.

As shown in Figure 11 the performance characteristics of a 10-inch Russian turbodrill indicate that maximum power and turbine efficiency



Wire Rope at Work—Far out on the rolling West Texas prairie, the contractor was putting down a wildcat well when this photograph was taken. Drilling at that time was in the Ellenburger formation; it had already passed 7200 ft, and the plans called for going another 300.

The rig was equipped with a jackknife mast and approximately 3500 ft of 1⅛-in. 6x19 rotary line. This stout wire rope was Purple Strand Form-Set, Bethlehem's top-grade preformed. Like all Bethlehem rotary lines, it handled the heavy strings of drill pipe with no fuss or strain, meeting every demand of the job with plenty to spare.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:
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occur at a shaft speed of about 600 rpm, or half the no-load or idling speed of 1200 rpm. Observe that the torque drops to zero at the idling or no-load speed, and at the other extreme, with the turbine stalled, the torque is then twice the rated value developed at 600 rpm. This fixed maximum limit on the torque at stall is another pertinent advantage over the rotary, and is an automatic built-in protection against excessive overloading of the pipe in deep holes.

Since the maximum amount of power which the turbine can generate for the bit is dependent on a certain optimum range in shaft speed, which is between about 550 to 800 rpm, as noted at the top in Figure 11, and since this power can only be realized by properly adjusting the external braking action by suitably loading the bit, it is seen that the driller sorely needs to know the shaft speed so he can apply the proper weight on bottom. Audible sounds emanating from the bottom hole turbine and bit become meaningless with depths below a few thousand feet. The "blind" operating procedure used to date to keep the bit working, has been first to stall the bit by applying excess weight, and then to back off a few tons to allow drilling to proceed. Observing and using the bit weight which seems to give the highest penetrating rate, has evidently been the usual method, but this is a rough visual approximation which would not always be conducive to best or consistent results with the turbodrill.

The further test data in Figure 12 shows what is reported to happen with a 10-inch Russian turbodrill as the bit loading is progressively increased right up to the peak penetrating rate, beyond into a zone of speed instability, and finally to a complete stall. To get the most footage the driller, of course, should try to operate as close as possible to the critical point near the top of the penetrating rate curve. Since the pump pressure, as shown in Figure 11 will tell him virtually nothing in the turbo's working speed range, a speed indicator at the driller's stand would be a decided advantage which should permit adjusting the bit load to maintain the bottom hole conditions for optimum power consumption by the bit. An electric speed indicator for this purpose was described in the ASME Paper No. 55-Pet-16, entitled, "Progress of Turbodrill Development in California," which was presented by Postlewaite at the ASME Petroleum Mechanical Engineering Conference in New Orleans in September, 1955. Although this device is still in the development stage, certain down-hole tests have demonstrated that this principle of transmitting speed signals promises to be workable. Extending the application of this instrument to automatically control the proper bit weight-speed relationship also now appears attractive.

What It Means to You. The turbodrill, if properly applied, appears to be the most significant improvement in the method of drilling since the rotary was introduced in 1901. The reduction in unit drilling cost that is promised by the new turbodrills, based on information available in various credible published reports, may soon be demonstrated in this country. The aspects bearing on the effective use of this equipment, and which have been noted in the references cited at the end of this paper, are summarized as follows:

a. The penetration rate in rock is faster.
b. Better utilization of bits is possible.
c. More effective utilization of the drilling crews.
d. The drill pipe and tool joints should be lighter and probably cheaper.
e. With suitable heavy drill collars between the turbine and the bit hole deviation has been controlled.
f. Directional drilling is possible with the turbodrill.
g. Longer pipe life.
h. Fewer twist-off fishing jobs with non-rotating drill pipe.
i. The operations on the surface are relatively quiet with the turbo since the rotary table noise is virtually eliminated.
j. Swivel and rotary table maintenance should be minimized since the pipe is only turned occasionally.
k. Several turbos can be coupled together in series to permit a reduction in flowrate and bit speed as the hole deepens.
l. The hole gage is maintained more accurately with the turbodrill.
m. In foreign practice rubber protectors have not been required on the non-rotating drill pipe.

What Is Required for Turbodrilling. To realize the above, there are certain requirements to be met in outfitting and running a rig to operate effectively with 8-inch or 10-inch diameter turbodrills. These are enumerated below.

1. A minimum of three turbodrills are required per rig to permit turbo maintenance and continuity of drilling.
2. Provision of adequate pumping facilities to deliver about 800 to 1000 gpm, and at sufficient pressure to satisfy the 600 to 1000 psi additional pressure drop across the turbine.
3. Effective pulsation dampeners should be used. This smooths out the hydraulic loading on the turbo's thrust bearing, as well as the operation of the bit.
4. The drill pipe should be of a larger diameter than is normally used. The tool joints should be designed for a large bore to cut down flow resistance. The kelly should be at least 6 inch with a large bore, and the passageways through the bit should be enlarged to accommodate the increased mud flow.
5. The mud should be desanded to minimize wear on both the turbine and the mud pumps. The sand content should not exceed 5 percent, and 1 to 2 percent will probably be found more economical.
6. Means should be provided to indicate the turbine speed to the driller.
7. Personnel experienced in the proper use and maintenance of the turbodrill is most essential for the successful utilization of this new tool in our drilling.

ACKNOWLEDGMENT

The authors wishes to acknowledge assistance from Dresser Industries, Inc., Byron Jackson Division of Borg Warner, Hughes Tool Company and the National Supply Company. They are also grateful to The Carter Oil Company which released certain information on current turbo test drilling in Holland.

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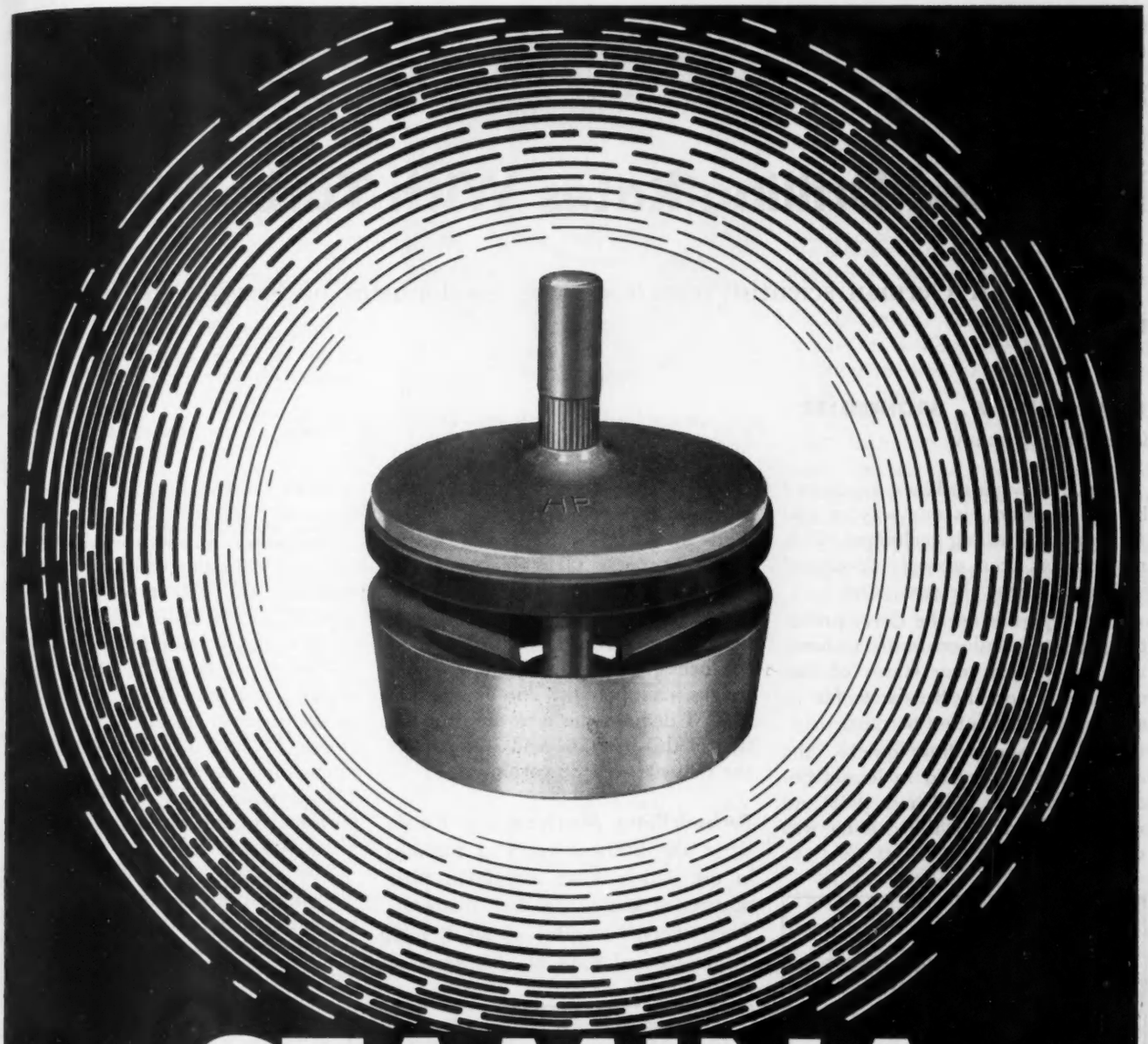

STAMINA

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The Russian Claim . . .

Increased Drilling Rates With Turbodrills

A German scientist reports on the development of Russian drilling techniques.

By DR. ING. W. GRONEMEYER
Clausthal, Germany

DRILLING WITH turbines, as claimed by the Russians, is one way of improving the drilling technique. This method has been strongly developed in Russia during the past years.

This report is on the development of drilling techniques with turbines and the present day status of this drilling method in Russia as far as obtainable information permits.

Table 1 shows how quickly the development advanced in Russia between the years 1948 and 1953 and what percentage of the drilling was done by turbines.

TABLE 1

Percent of Total Wells Drilled By Turbodrilling Method

Year	Percent
1948	31.1
1949	44.4
1950	48.6
1951	57.1
1952	61.1
1953	75.8
1954	....

A turbine with vertical axis is mounted to the lower end of a stationary drill stem. High-pressure pumps force the drilling fluid through the stem into the turbine situated immediately above the bit and put the turbine shaft into rotation. The bit is screwed to the shaft of the turbine. The turbine and the bit make approximately 500 to 600 revolutions per minute. Like the rotary method, the mud flows to the surface between the drill stem and the well bore. By regulating the pump pressure it is possible to adjust the speed of the bit to the respective rock formations. The drill stem does not rotate inside the hole; it merely serves to pipe the fluid into the turbine. The entire drilling process takes place at the bottom of the hole.

The turbine, a T 12 M 10″ model, shown in Figure 1 has a diameter of 10 inches, a length of 28 feet and weighs 5260 pounds. The designation T-12M denotes the type of construction of this machine and 10″ denotes the diameter of the turbine.

Turbodrilling Method. In Russia there are different types of turbines in use which differ mainly in their number of stages and their diameter. Their over-all length is about 26 feet. The technical data of the types of turbines mostly used at present are shown in Table 2.

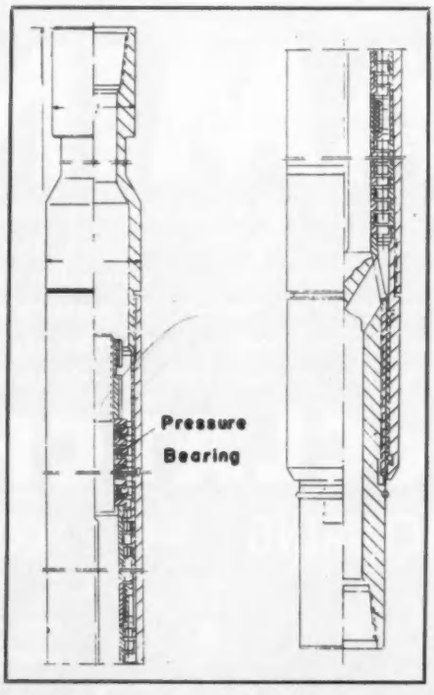

FIGURE 1—A profile of the T 12 M 10-inch turbine.

The pump capacity ranges between 635 and 930 gallons per minute. For example, the 100-stage turbine of type T 12 M 2-10″, a turbine of latest design, transmits a torque of 2170 feet per pound to the bit with a pump capacity of 875 gpm. The pump pressure in this case was between 1175 and 1470 pounds per square inch, at a depth of 6560 feet. The pressure in the turbine is proportional to the torque. In this case it was 800 psi.

The number of revolutions of the bit while drilling is about half of the revolutions while idling. The drilling is controlled by a drillometer, a pump manometer and a pump flow meter. The use of a bit revolution counter is also planned. The efficiency of the turbine drill is about 60 percent.

The increase of the pump capacity results in higher revolutions, higher torque, and normally a higher drilling rate. However, there are natural limits to the increase of the pump capacity. Therefore, the diameters of the turbo-channels were enlarged and the pump capacity as well as the torque were increased without creating a higher pressure in the turbine. With these turbines the efficiency was boosted by 15 to 30 percent.

In other experiments the turbine stages were augmented without changing the pump capacity and the pressure inside the turbine. The resulting length made the construction of machines of this kind very difficult from the engineering standpoint. Therefore, initial experiments were made by welding together two turbines of 100 stages each.

In 1953, a prolonged turbodrill,

T12M2-10" with 150 stages, was buit and tested. About 10 feet were added to the case of the drill. The screw connection was welded together for safety reasons. The over-all length of this new drill was 38 feet. The technical data of the turbodrill T12M2-10" with 100 and with 150 stages are shown in Table 3.

It follows that with a turbine of 150 stages at a pump capacity of 725 gpm a higher bit load is possible than with a turbine of 100 stages at 872 gpm. Comparative values of the capacity of the two turbines are shown in Table 4.

It is interesting to compare a rotary drilling method and a turbodrilling method (150 stages) at about equal conditions: (Note Table 4-A).

FIGURE 2—A rotor and stator from the T12M 10-inch turbine.

TABLE 2
Technical Data on Turbines Presently in Use in Russia

Type of the Turbine	Circulating Rate in gpm.	Revolutions per Minute	Pressure Inside the Turbine in psi.	Torque in ft/lb.	Diameter in Inches	Length in Feet	Weight in Pounds
T 14 M—9¾	603 634 713	610 640 720	735 808 1014	1150 1272 1627	10.05/9.85	25.5	4840
T 19—10"	603 634 713	520 550 620	735 808 1030	1402 1555 1972	10.5	27.5	4840
T 12 M—8"	555 603 634	600 650 685	603 706 780	882 1040 1150	8.46	27.6	3740
T 12 M 2—10"	713 794 872	550 610 670	603 735 897	1505 1850 2240	10.05/9.85	26.9	5250
T 12 M 1—8"	555 603 634	645 700 735	515 603 662	889 1048 1157	8.35/8.27	28.4	4600
T 12 M 2—8"	555 603 634	590 640 675	515 603 662	851 976 1083	8.19/8.07	27.6	3200

TABLE 3
Operating Characteristics of the T12M2-10" With 100 and With 150 Stages

Number of stages	Pressure Inside the Turbine psi.	Circulation Rate, gpm.	Torque Ft./Lb.	Revolutions per Minute	Efficiency Percent
100	882	872	2170	640	60
150	882	725	2205	520	60

TABLE 4
A One Run Comparison of the T12M2-10" With 100 and With 150 Stages

Type and Size of Turbo-Drill	Type and Size of Bit	Drilling Pressure Psi.	Pump Pressure Psi.	Pump Capacity Gpm.	Average Drilling Rate Ft./Hr.	Total Footage, Feet
T 12 M 2—10"—150	11¾" Three Cutter	147–338	1180–1470	603–665	17.1	78.5
T 12 M 2—10"	11¾" Three Cutter	88–191	1180–1470	714	7.9	46.6

TABLE 4-A

	Rotary	Turbo
Drilling Interval	5900-6560	5900-6560
Rotary Table Rotation, r.p.m.	100	.....
Footage Drilled, Feet	69	95.2
Net Drilling Rate, ft./hr.	6.6	21.6

TABLE 5
Operating Data for the TS1-8" With 190 Stages

Pump Capacity* Gpm.	Optimum Revolutions Rpm.	Torque Ft-16	Capacity in Horsepower	Pressure Inside Turbine, Psi.
570	540	1910	191	1045
540	510	1725	162	933
510	480	1490	132	825
480	450	1310	108	726

*Specific gravity of mud 10.0 lb./gal.

The results show a threefold increase in drilling rate by the turbodrilling method at about one and a half as much total footage.

At the same time a turbodrill TS 1-8" with 190 stages was developed from the already tested turbodrill T12M1-8". The technical data of this new drill are shown in Table 5.

The type TS1-8" transmits a torque of 1725 feet-pounds at a pump capacity of 540 gpm, while type T12 M1-8" at equal pump capacity transmits a torque of 905 feet-pounds only.

Comparing the data of these two turbodrills at different pump capacities in drilling holes of 8200 feet the results are for type T12M1-8" at a pump capacity of 635 gpm, a torque of 1190 ft-lbs and for the type TS1-8" at a pump capacity of 555 gpm, a torque of 1725 feet-pounds. This means an increase of about 50 percent with the section turbine.

This section turbine is built from the parts of the conventional machine T12M1-8". The upper section has 98 stages with 10 pressure bearings while the lower section has 92 stages with 18 pressure bearings. The mounting is done separately. The shafts are put together by a split sleeve consisting of two half sleeves. Figures 3A and B.

Tests were made at the end of 1953 with the new turbine TS1-8". Drilling was begun at 6560 feet at a pumping rate of 507 to 555 gpm. The pump pressure ranged between 1325 and 1620 psi. The bit load was 30,000 to 40,000 pounds. Approximately 1970 feet were drilled. Thirty-three bits were used at an average rate of 52.5 feet per bit. The results of this section turbine were about 70 to 80 percent higher than those of the conventional turbine T12M1-8".

These results show that the problem of increasing the torque seems to be practically solved by augmenting the number of stages. This is particularly important for deeper holes since

hydraulic losses occur with increasing depth.

The Rigs. The capacity of turbodrilling depends primarily upon the pumps which drive the turbines by the flow of the drilling fluid and keep the hole clean. Until 1950 turbodrilling was impaired by lack of adequate and efficient pumps.

Heavy rigs for rotary and turbodrilling have been developed with which a high drilling capacity can be reached. These rigs are powered by diesel engines and are easily convertible to electric power.

The final developments of modern, heavy, compound, rigs up to 10,000 feet was the type Uralmasch 5D with diesel engines and a total capacity of 1500 horsepower. In addition a new 16,500 foot rig was put to work in 1953 which has a drive of 2000 hp and was equally well suited to either the turbo or rotary drilling methods. The technical data of these rigs are shown in Table 6.

Both drilling rigs are equipped with modern devices for ease of operation and efficiency, including:

- Newly developed rail-pneumatic friction clutches in place of claw and disk clutches.
- Pneumatic operation of the rig.
- The compounding of the engines.
- Hydraulic brakes and pneumatic operation the band brakes.
- The application of duplex-chains upon milled and thermo-treated chain wheels.
- An extra gear for hoisting of the unloaded hook which saves unnecessary shifting by the operator.
- Automatic adjustment of compressor pressure and direct connection of the rail-pneumatic clutch with the compressed air.

TABLE 6
A comparison of the capacities of a 10,000 foot (Uralmasch 50) and a 16,500 foot rig (Uralmasch 35).

	Units	Uralmasch 5D	Uralmasch 3D
Carrying Capacity	tons	130	200
Maximum Depth	ft.	10,000	16,500
Capacity, Installed	hp.	1,500	2,000
For Hoisting	hp.	750	1,200
For Mud Pumps	hp.	1,000	1,000
Maximum Line Pull:			
At the Drum	tons	14.5	22.0
Number of Gears	..	4	5
Power I. Gear	tons	100	136
II. Gear	tons	75	113
III. Gear	tons	40	63
IV. Gear	tons	12	38
V. Gear	tons	.....	25
Number of Gears:			
At Rotary Table	..	3	4
Rotary Table Speed	rpm.	79,119 206	43,100 170,260

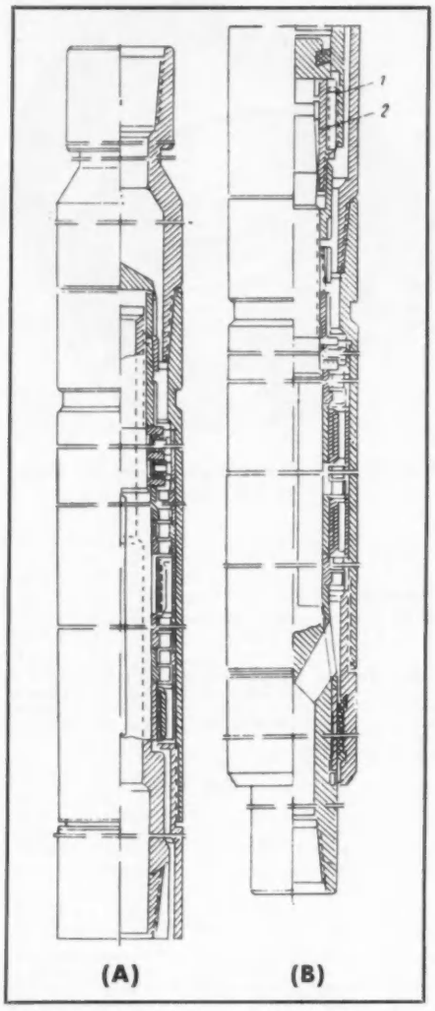

FIGURE 3—Cross-section of the section turbine, T 12 M ⅛-inch. The shafts are joined by a split sleeve.

Both rigs had operated without trouble and were still in good condition after drilling 16,400 to 19,700 feet. The hard wear on the chain of the hoist was very low. Idle hours caused by repairing of the chain dropped from 5 percent to one percent of the working hours. The aforementioned pumps have been working for four years at a capacity of 800 to 1030 gpm at 1620 psi without trouble. In 1952 the diesel engines had been used an average of 2900 hours.

Circulation When Turbodrilling. When turbodrilling the circulation is of particular importance. Its purpose is not only to bring out the drilled particles or hold them in suspension, or cool the bit, but it serves in particular to drive the turbines.

Special emphasis is placed upon a good drilling mud in rotary drilling, while turbo-drilling requires a fluid free of drilling mud in order to spare the turbines. The lifting ability of rotary drilling fluid must be carefully controlled due to the low annular velocities. This lifting ability does not play an important part in turbodrilling because of the high annular velocities. The high revolutions of the turbine grind the drilled particles very fine so that it can be easily flushed out.

For these reasons the change is toward the use of water in drilling. Also clay has a higher hydraulic resistance. With water as a drilling fluid, it is possible to achieve a higher pumping rate without running into too high pump pressures. At a pumping rate of from 700 to 730 gpm a pressure of 1320 to 1470 is obtained with a clay mud, while with water the pressures are in the neighborhood of 880 to 1030 psi. Any extra particles in the drilling fluid cause hard wear of the parts of the pumps and turbines. The use of water over a clay mud is also much cheaper.

In 1952 the first wells using water exclusively as the drilling fluid were brought in. No jamming or sticking of the drilling tools was reported. The drilled particles were easily circulated out with water.

Initially clay mud was used to drill the holes for the 16-inch and 12-inch casing and then the system was changed to water. The 12-inch was set at from 200 to 820 feet. Since 1953, however, the majority of the wells are drilled from the start with water. See Table 7.

It was found that before pulling the turbine from the hole that it was necessary to circulate for a long period of time so as to avoid settling of cuttings around the bit. No case was reported of a stuck turbine due to the interruption of circulation. In one case tools which got stuck during drilling with clay mud were washed free with water.

A disadvantage of the water drilling is the greater danger of corrosion

TABLE 7
A yearly comparison of drilling rates and footages after the introduction of drilling with water

	1949	1950	1951	1952	1953
Percent of Total Wells Drilled with Water	.....	.....	.....	12.2	76.2
Average Total Capacity (Ft./Rig-Month)	1314	1400	1730	1925	2420
Average Footage per Bit in Feet	52.2	54.2	52.7	55.5	68.3
Average Drilling Rate in Ft./Hr.	7.0	8.9	11.0	14.9	34.1

of the tool joints. The joints are lubricated with graphite and made up tight.

In some areas the use of drilling mud could not be entirely avoided. There were clay beds in the Devonian between 4900 and 5250 feet having a thickness of 80 to 100 feet. The water caused the clay to swell and prevented further drilling. In a case like this the change to drilling mud should be done gradually without interrupting operations. Formerly the water was displaced by prepared drilling mud, this took 3 or 4 days, and resulted in fluid losses. The gradual change to a clay base mud can be accomplished gradually in a 24-hour period. In order to assist the initial formation of a filter cake 1320 to 1760 pounds of peat, 440 pounds of clay and 88 to 110 pounds of caustic soda were mixed with water in a mixer and added to the water circulation.

In 1953 a well drilled with water had swelling clay between 5250 and 5400 feet. This horizon was drilled through with an eccentric bit mounted on a bent drill stem (5°) thereby enlarging the hole with this reach. The enlarged annular space was then cemented. After the cement had set the well was continued with water to the intended depth of 5600 feet.

Another method of avoiding the clay contamination of drilling water is fast penetration of the clay beds. On the above mentioned well the clay beds were located immediately above the oil zone. Within 36 hours the clay bed and oil zone were drilled and then cased. During this time no swelling occurred.

An ideal solution of turbodrilling would be to separate circulating fluid and driving fluid. That is, to either drive the turbine by electric power or to part the circulating fluid and the driving fluid.

Drilling Capacity. A comparison between rotary and the turbodrilling methods showed an average increase of 1½ to 2 times the capacity with turbodrilling under analogous geological conditions. This high drilling capacity of the turbodrill was reached by a more efficient transmission to the bit. With rotary tools at 10,000 foot depth with 4½-inch drill pipe, 7½-inch bit turning at 125 rpm, the transmission to the bit was 40 horsepower or about 1.1 hp per square inch of hole. With turbine drilling using 6⅝-inch drill pipe, a 12½-inch bit and a pump capacity of 800 gpm the highest possible transmission to the bit was 200 hp or about 1.7 hp per square inch of hole bottom.

Table 8 shows a comparison of data of several wells brought in with turbines during 1953.

It is interesting in this table to notice how little time was needed for fishing and the good time made for net drilling of wells 321 and 381.

Finally, reference may be made to a record well brought in during the Spring of 1954 in the area of the so-called "Second Baku," located in the Eastern part of European Russia. The following data were reported on that well:

TABLE 8
A Comparison of the Drilling Time Break-down for Several Wells Drilled by the Turbine Method During 1953

	DESIGNATION OF PRODUCTION WELLS				DESIGNATION OF WILDCAT WELLS	
	295	316	321	381	528	410
Total Depth of Well, Feet	5960	5580	5850	5660	5840	6260
Starting and Completion Dates	12/26 2/19	3/18 4/20	5/10 6/ 4	6/19 7/18	8/9 9/22	10/15 12/14
Total Footage Per Rig-Month	3220	5070	7430	5710	4230	3018
Average Drilling Rate, Ft./Hr.	23.2	24.2	41.5	41.8	28.1	28.7
Number of Bits	95	69	62	66	69	67
Footage Per Bit	63.9	80.4	94.5	86.6	84.6	93.5
Type of Power	Diesel	Electric	Diesel	Diesel	Diesel	Electric
STATEMENT OF WORKING HOURS						
Total Working Time, Hrs.	1307	800	571	688	997	1404
Productive Time, Hrs.	1130	758	515	627	898	1145
As Follows:						
Net Drilling Time, Hrs.	256	230	126	137	208	207
Rig-Up and Tear-Down, Hrs.	388	225	205	230	257	327
Transportation, Hrs.	50	22	16	21	33	41
Changing, Bits, Hrs.	47	40	38	57	51	35
Running Pipe, Hrs.	165	80	68	87	79	168
Miscellaneous, Hrs.	324	161	62	113	270	367
UNPRODUCTIVE HOURS, Total	177	42	56	61	99	259
As Follows:						
Fishing and Down Time, Hrs.	14	....	....	....	....	3.9
Maintenance	91	24	30	23	32	77
Waiting on Cement, Etc., Hrs.	72	18	26	38	67	143

Total Depth, feet	**5580**
Total footage in ft./rig/month	**8580**
Total drilling time	**19.5 days (469 hrs.)**
Average drilling rate ft./hr.	**64.6 (Min. 26.6)**
Total footage per bit	**113.8**
Number of bits used	**49**
Avg. time on bottom per bit, hrs.	**.....**
Productive working time, percent	**94.7%**
Net drilling time, hrs.	**86.**
Time for trips, hrs.	**153.3**
Casing, hrs.	**80.1**
Miscellaneous, hrs.	**84.4**
Unproductive time, hrs.	**24.**

This capacity was reached with a rig having three pumps of a total capacity of 1100 to 1200 gpm. The bit load was between 60,000 and 70,000 pounds. Water was used from the surface casing to total depth. On the basis of this experience there are possibilities being studied in Russia at the present time to reach a capacity up to 10,000 feet per rig per month with this drilling method.

Advantages and Disadvantages

- **Faster drilling progress.** The availability of higher working capacity at the bottom of the hole means faster drilling. This advantage remains even when bigger bits than those customarily used with rotary drilling are used.
- **Straighter drilling.** The bit speed in turbodrilling is higher, the bit weight is lower and the neutral point of the drill stem is higher up the collars than when greater weight is used.
- **Full gage drilling.** Since the drill stem does not joggle and the drilling is straight, a hole is made with little bit walking. This is an advantage when running and cementing casing.
- **Low wear on the drill pipe.** The hard wear on the outside of the pipe and the tool joints is greatly reduced because the string rotates in some cases with 10-15 rpm only or in many formations need not be rotated at all.
- **Fewer fishing operations.** Most of the causes for parted pipe are eliminated by turbodrilling. The pipe is not exposed to sudden dangerous momenta like special loads or bending pressure which may occur at any time while rotary drilling. The pipe does not drag on the wall of the hole except at very low speeds. Twisting off does not occur.
- **Fishing of bit cones** and other

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parts of bit does not happen so often.

• **The danger of twisting off** is always present while rotary drilling because of its high speeds. Furthermore, the formation of keyseats is another frequent cause of fishing operations. While turbodrilling this happens less frequently because the hole is straighter and the stems turn slowly or not at all.

• **For turbodrilling** the most frequent cause of fishing operations is falling, swelling, or flowing rock formations. However, a straight hole, tension loaded drill stem, and very low rotative speeds of the stem reduce this danger very much. Turbodrilling does not create any new drilling difficulties and eliminates most of the existing difficulties of rotary drilling or reduces them to a great extent.

• **Less strain on the rig.** The strain on the swivel and the rotary table is considerably reduced. The mast base vibrates only slightly. This results in a reduced strain on the rig in general.

• **A clean hole.** The lifting capacity of the drilling mud is improved by the higher annular velocity. The drilled particles are of finer grain because of the higher speed of the bit, and can be brought out better.

• **Interchangeability.** The turbodrilling is interchangeable with the rotary-drilling method.

Disadvantages of turbodrilling.

If difficult drilling conditions prevail requiring a heavy and viscous mud the turbodrill cannot be applied as long as these special conditions exist.

For turbodrilling the speed of the bit varies between 200 and 600 rpm. Therefore it is possible that certain beds may not be drilled as well as with rotary methods at a bit speed of 50 to 70 rpm. The final answer, however, could only be given after extensive drilling experience.

Strain to the mud pumps. The strain to the mud pumps will be higher because the pumps have to perform more for turbodrilling. For this reason it is necessary to keep the sand content of the fluid as low as possible. For practical purposes a sand content of less than 3 percent by volume is considered good.

Either as general successor of, or as supplement to, the rotary-method the turbodrilling method promises to contribute an important share towards increasing the capacity and rentability of deep drilling. —**The End**

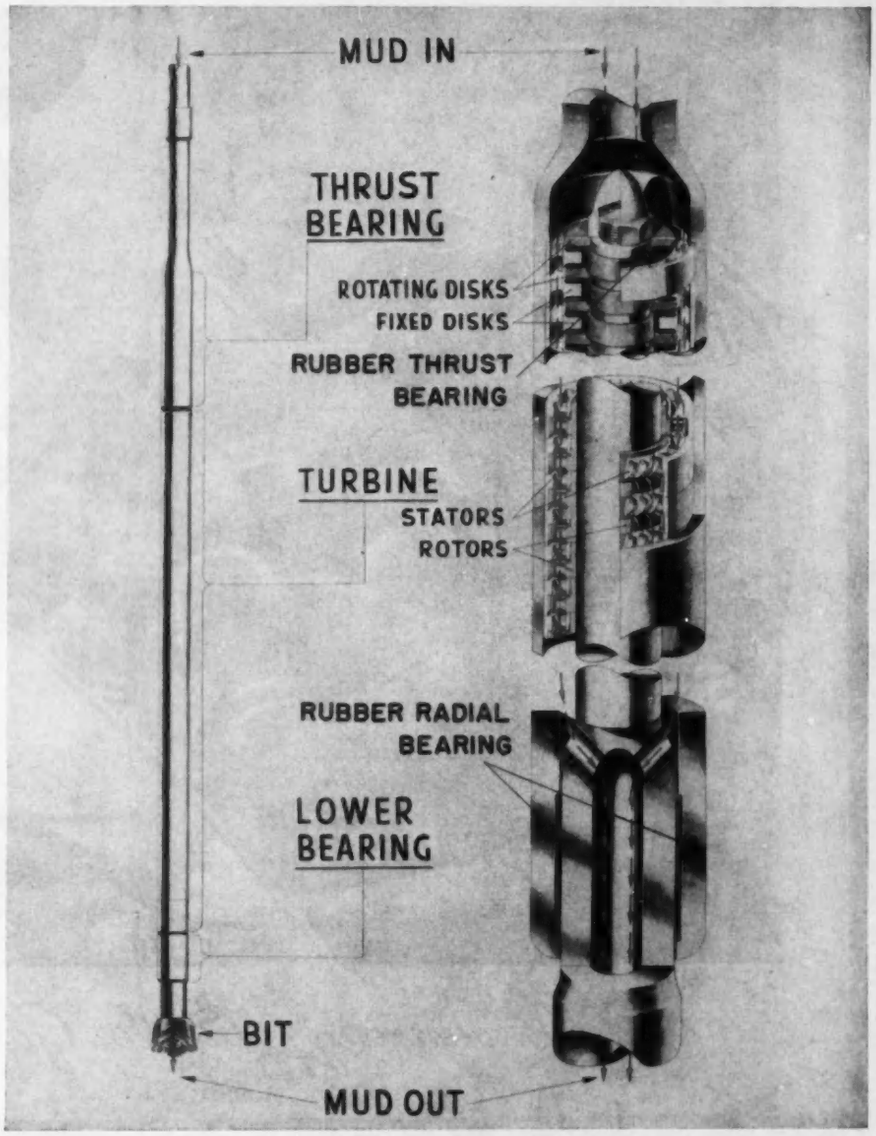


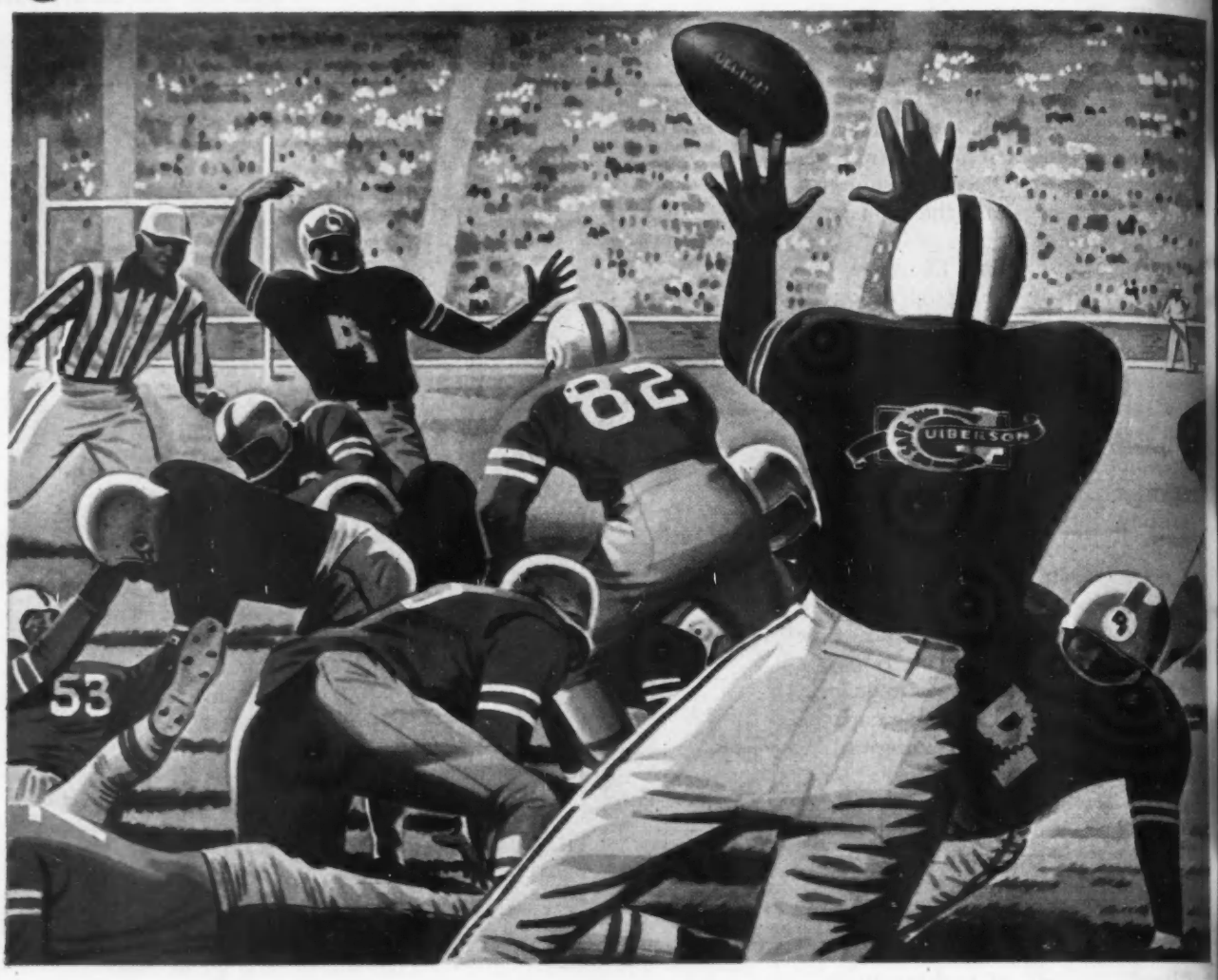
FIGURE 1—Cutaway drawing of turbodrill showing the important components and operational features.

Russian Turbodrills . . . How Good are They?

How do Russian technological advances compare with those of the U. S.? Russian turbodrills now in Dallas will soon be tested against American rotary equipment.

IN RECENT months the drilling industry has become increasingly aware of the possibilities inherent in having a down the hole source of power for driving the drill bit. Scattered and unsuccessful tests have been carried on in the U. S. since 1873, but only recently with reported success of Russian turbodrilling has there been much widespread interest in this method.

Now, tool manufacturers and drilling personnel alike are anxiously awaiting the results of tests presently



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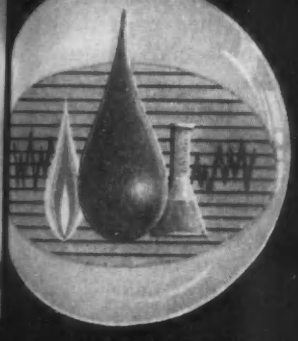

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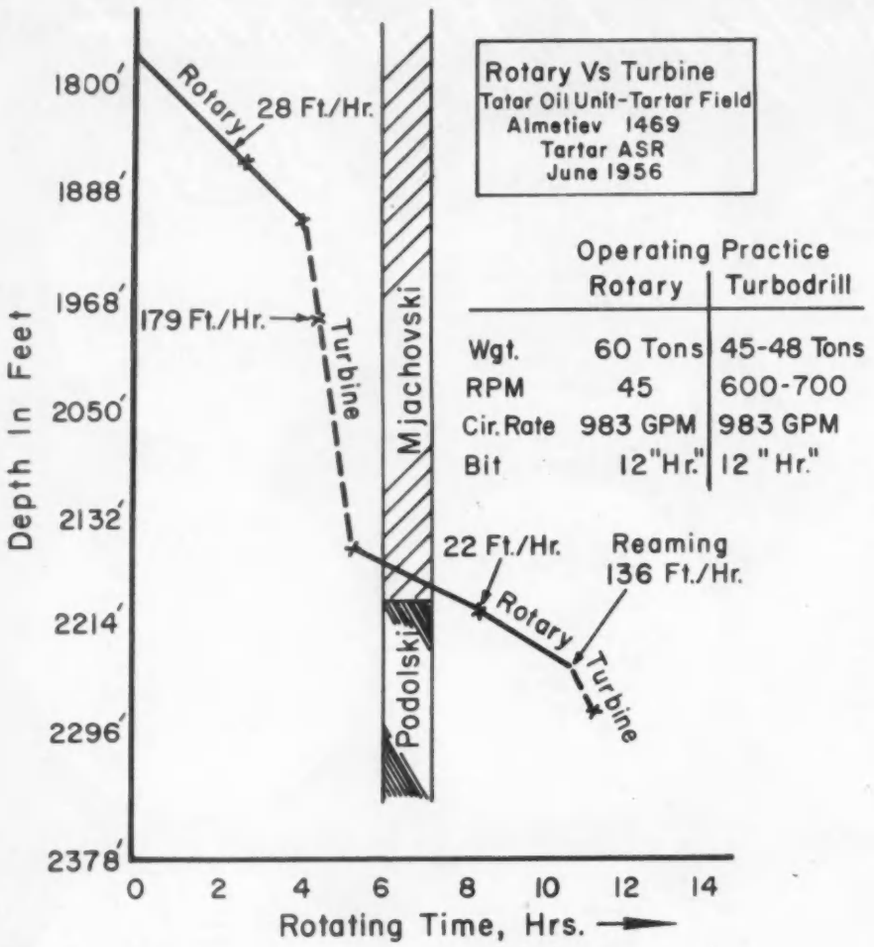


FIGURE 2—Comparison of turbodrill and conventional rotary drilling rates when penetrating the hard Carboniferous formation (equivalent to a Mississippian limestone) in Russia.

being conducted on 40 imported Russian turbines. How and why were these turbos obtained? Are claims made for turbodrilling far fetched and unreasonable or can this method further improve drilling progress here in America?

Most readers are already familiar with earlier turbodrill experiments and some of the results, both here and abroad. Dresser Industries, Inc., first entered the field of turbodrilling when they acquired the EDCO turbodrill in 1950. It consisted of a multi-stage, direct drive, impulse turbine similar to one of the early Russian models. Dresser undertook this development work but when it was completed they found that the power output and efficiency of this turbine were too low for economical drilling.

There were other turbodrills that were tried unsuccessfully but the Russians were the first to come up with one that seemed to work economically and efficiently. In a nation in which the state is omnipotent, there is no question in industrial development of responsibility to stockholders, no necessity for showing an economical operation, no need to show a margin of profit. Only the blessing of the State is needed upon a given project. Once this has been obtained, there is little question of the millions spent upon research; the hundreds of personnel channelled into such a project, or the vast amounts of money spent in experimenting and testing. The State is answerable only to itself, and has no customer problems such as must be faced in the U. S. And, so, the Russian turbodrill development progressed.

The first Russian turbodrill developed by M. A. Kapelyushnikov in 1925 was a single-stage high-speed turbine driving the bit through a planetary reduction gear. Its use was discontinued in 1934 because it was considered less efficient than conventional rotary drilling.

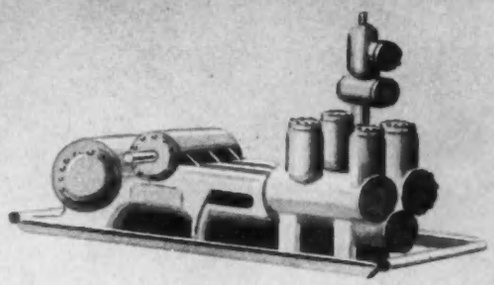
In 1935 a new type of multi-stage direct-drive turbodrill was designed by the Russian engineers but it was not fully perfected until after the war. This was considered such an important achievement that R. A. Ioannesyan and M. T. Gusman were awarded the Stalin prize for their improvements on the turbodrill. In 1947 the Russians had a fairly good turbodrill and an American industrialist had several meetings with them to discuss the possibility of making a license agreement. They promised to show the tool working in the field but security regulations interfered. It was therefore impossible to conclude an agreement at that time.

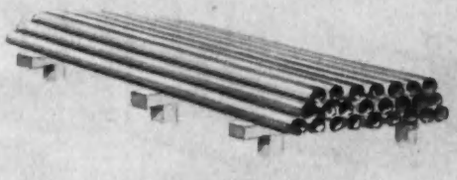
The first direct-drive multi-stage turbodrills were equipped with sealed roller-bearings which failed frequently because drilling mud contaminated the lubricating system. The Russians decided that the turbodrill must be "de-refined" into a rough and rugged tool to meet oil field conditions. The result was the development of a rubber thrust bearing (see Figure 1) which is lubricated by the drilling mud and which need not be sealed against the entrance of abrasives.

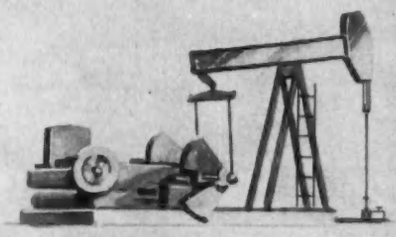
While the Russians are a practical people operating with a minimum of technical personnel, they carried on research work in a special institute, the All-Union Institute for Scientific Investigation for Drilling of Oil Wells, established for the study of turbodrilling. This institute was equipped with all of the instruments needed for the study of fluid dynamics, cavitation, and the behavior of viscous liquids. The facilities include a small shop capable of turning out a complete turbodrill even to making the steel castings for the rotors and stators. They also have complete heat treating facilities for the thrust bearings.

The staff of about 200 people at the institute includes 30 engineers and chemists and two experts on hydrodynamics. In the laboratory are two dynamometers, a stroboscope and a high-speed motion picture camera for studying the action of drill-bit teeth on the formation. They also have a turbine in a lucite case to study cavitation. In general, their instrumentation is crude but effective. In dealing with the Russians we must not be deceived by their appearance. They look like peasants and they need materials to work with but their technical skill should not be underestimated.

The Russians have developed four







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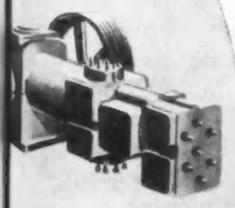

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Forty Russian turbodrills in heavily reinforced crates arrive in Dallas at facilities especially prepared for testing and maintenance of the turbos.

sizes of turbodrills in two different basic types. One type, the T12M2, is for driving a regular rock bit while the other, the KTD, has a hollow shaft to accommodate a wireline core barrel. They have also developed a tandem drill, the TS4 which permits putting together two or three turbines to obtain a total of as many as 240 stages on one shaft. These are used in soft formations where high torque and low speed are necessary.

In the Bashkir oil field between Bugulma and Tuymazy in the Tartar Republic, 170 drilling rigs are running, all using the turbodrill. The rapid development of this field is due entirely to the use of the turbodrill. They are drilling wells in eight days that would require 36 days by conventional rotary drilling. The wells in this field are from 5400 to 5600 feet deep and it is hard drilling practically all the way. They use 61 bits per well and average 100 feet per hour. A breakdown of the time spent on the average well is as follows:

Actual drilling time	54 hrs.
Adding pipe	22 hrs.
Pulling pipe	126 hrs.
Total	202 hrs.

A graphical comparison of rotary and turbodrilling in the Tartar Field is shown in Figure 2.

In turbodrilling they carry from 20 to 27 tons weight on the bit which runs at 400 to 900 rpm. Two 400 horsepower mud pumps are used and they operate at 1470 to 1760 pounds per square inch of pressure. With such a rig, and a 5⅜-inch turbine, they have drilled to depths of 15,000 feet. The turbodrills work best in the hard formations which are the most difficult for conventional rotary drilling to penetrate.

An American witnessed a test between conventional rotary drilling and the turbodrill. At the time they were drilling in dolomite at a depth of 1200 feet. The rotary was run at 250 revolutions per minute which is high for this formation. The weight on the bit was 20 tons and the maximum rate of penetration was 4½ feet per hour. In the same formation, the turbodrill with 20 to 24 tons on the bit drilled at the rate of 57 to 75 feet per hour. In both tests the mud pressure was 1470 to 1760 psi and the circulation rate was 950 gallons per minute.

There are three turbodrill repair stations in Bashkir and two in Tuymazy. A running record is kept of each turbodrill including the number of operating hours, when repairs were made, and the extent of the repairs. At one of these repair stations a random inspection of a number of turbodrills returned from the field was made and it was found that they did not need any attention except thrust bearing repairs. This was most surprising because in the earlier models of turbodrills designed in this country the greatest concern of the engineers was erosion of the turbine blading by the drilling mud. The Russians have apparently found a solution to this problem through extensive research and experimental work.

The solution of the problems involved in the design of a turbodrill depend so much on extensive field experience and data gained therefrom that it would be very costly and time consuming to build a successful turbodrill without this experience. Earlier plans called for bringing Russian drilling personnel into this country to eliminate the delay in acquiring this needed experience.

One of the important problems associated with turbodrilling is the design of the rock bits. Since the turbodrill runs at speeds ranging from 500 to 900 rpm as compared with rotary speeds of 50 to 250 rpm the bearings in the cutters of a standard rock bit invariably fail before the teeth are worn out. At the time Dresser was working on the Edco turbodrill their bit designers had no ready answer to this problem and said it would require extensive research to develop a satisfactory bearing for high speeds. The Russian answer to this problem can be obtained through an

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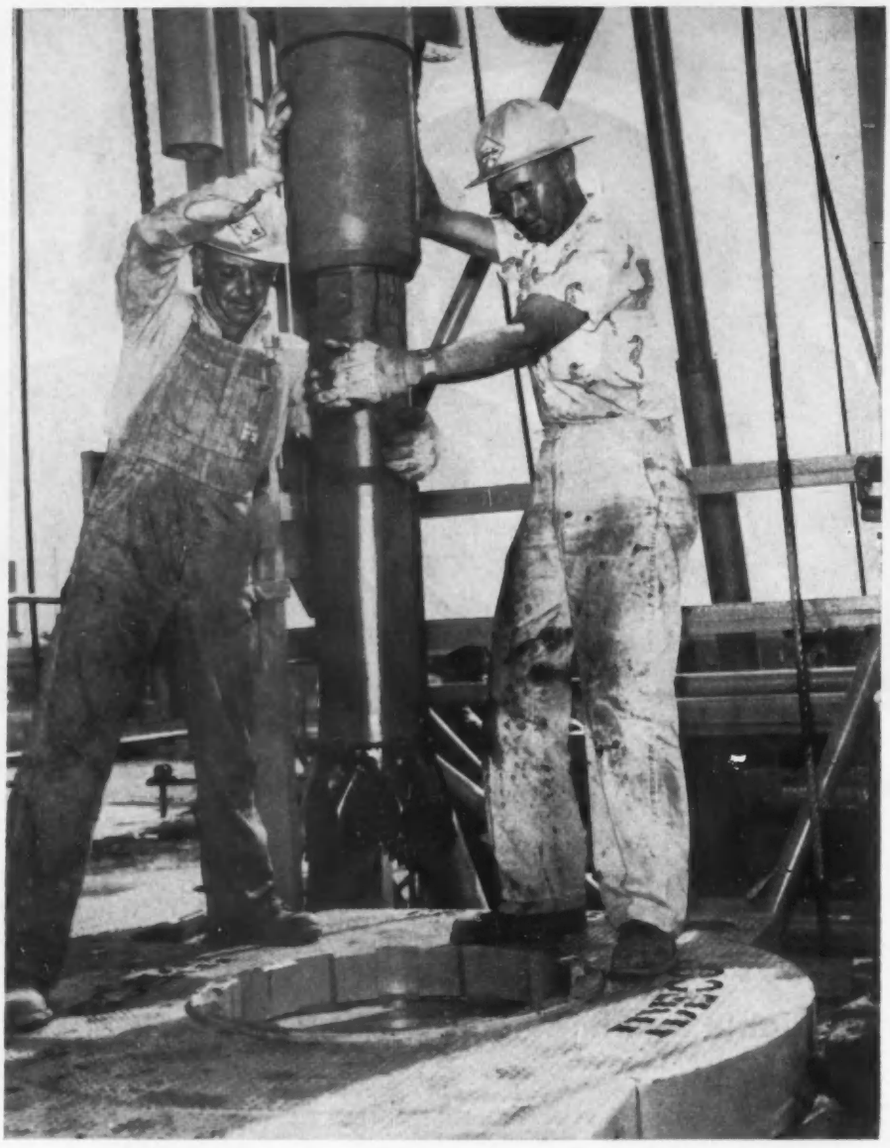


Drilling crew from Gardner Brothers prepares to run a 10-inch KTD turbodrill in the hole with a four-cone coring bit.

exchange of information on bit design. Such an exchange of information would be of greater advantage to the U. S. than to the Russians because our design data on bits for low rotating speed and heavy weights would be of little value to the Russians for use on their turbodrills. On the other hand, we have no design data or field experience on bits for operation at high turbodrill speeds.

It might be asked why the Russians are now willing to make their turbodrilling technology available to us. The answer seems to be that their vanity got the best of them because ever since the World Petroleum Congress in Rome last year they have been pressing to have the turbodrill tried elsewhere in order to get credit for their accomplishments. In time the turbodrill could revolutionize the oil industry in the U. S. as it has in Russia, where 70 percent of all oil wells are drilled and it would be a tragic mistake not to take advantage of this opportunity.

Consequently, the American concern entered into negotiations with the Russians and subsequently with Establissements Neyrpic for obtaining a licensing agreement for the manufacture and use of turbodrills in the U. S. and Canada. After many discussions and much delay 40 turbodrills representing three different types; the T12M2, in 6⅝-inch, 8-inch, 9-inch and 10-inch diameter sizes; the T54 in 5-inch, 6⅝-inch, 8-inch and 10-inch diameter and the KTD coring turbodrill in 8-inch and 10-inch diameter size were received in Dallas.

No time was lost in establishing a test turbodrill station and drillsite at one of the company's plants in Dallas. A small portable rig with a large independently driven triplex pump was moved in, and indoctrination tests for company personnel were under way. A trained drilling crew from a contract drilling firm is being used to operate the rig and to acquaint drilling and engineering personnel with the operating characteristics of the turbodrill. These preliminary tests are not designed to put the turbo through its paces as yet.

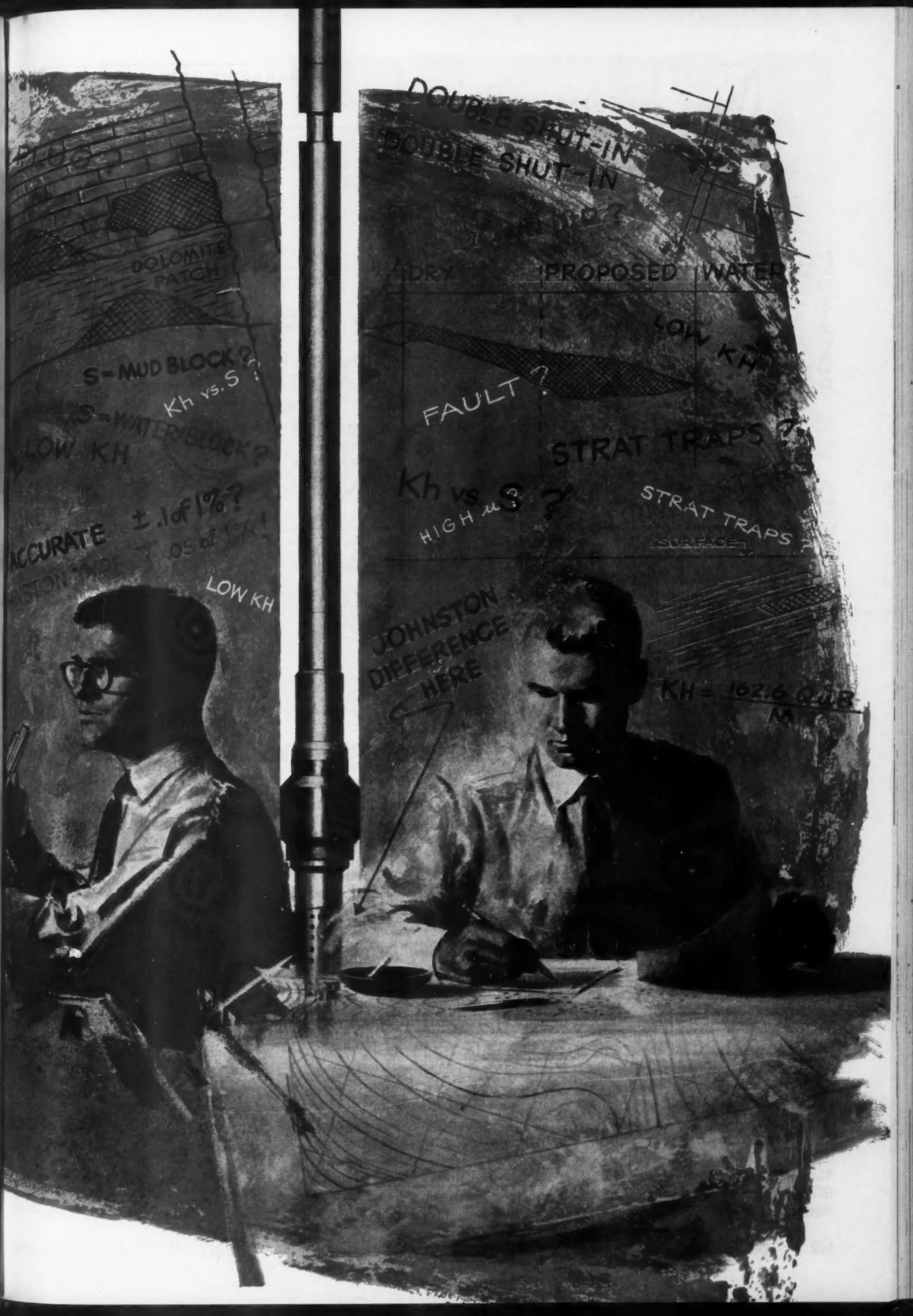
At the present time drilling and coring techniques are being tried under controlled conditions. A typical test while using the T12M3-10-inch with a 12¼-inch soft formation bit consisted of applying about 20 tons of drill collar weight to the bit and an indeterminable amount of weight due to the applied hydrodynamic head. Circulation was approximately 630 gallons per minute at 1350 psi. Pressure drop across the turbine at these rates is approximately 6700 psi.

One of the many characteristics of this drill that must be determined by tests is a means of calculating the amount of weight applied to the bit by the hydrodynamic action of the drilling fluid. It is necessary to keep the thrust bearings as nearly balanced as possible at all times, and knowing this weight can be quite important. If the down thrust, or weight, due to the hydrodynamic force, and the weight of the collars, is too far in excess of the weight applied to the bit then the top of the thrust bearings will wear excessively. If the reverse is true and the upward thrust is greater, then the underside of the rubber covered thrust bearings will wear excessively.

Upon completion of these orientation tests the turbodrill will be taken to the field, where it will be given comparative tests with regular rotary drilling in all types of formations under all possible conditions. Marketing or leasing arrangements have not been decided upon at this time, but it is hoped that the turbodrill will take its place in the drilling industry sometime in 1957. It is through these field tests and only through these tests that the big question of their comparable performance to standard rotary drilling will be answered.

ACKNOWLEDGMENT

Appreciation is extended to Dresser Industries, Inc. for their assistance in obtaining photographs and data for this article.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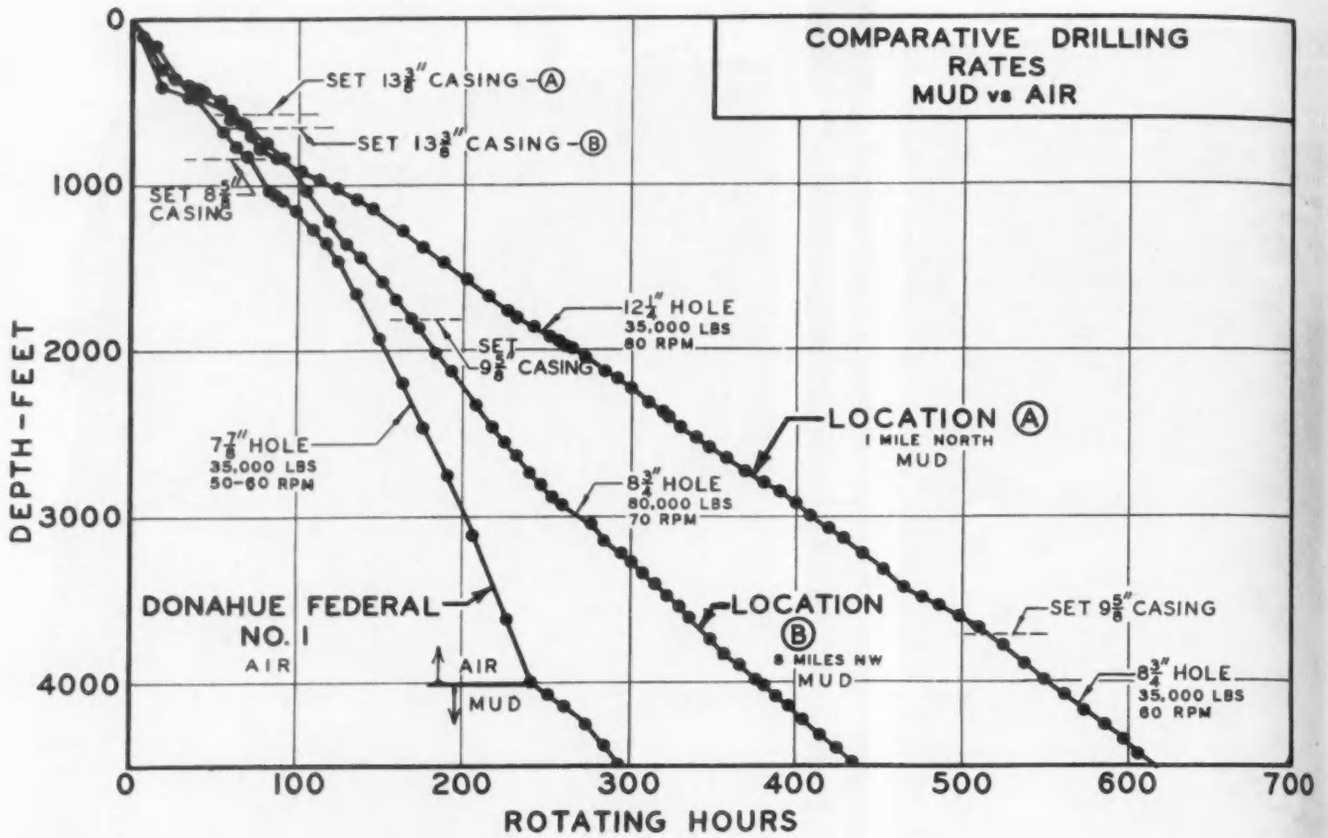


FIGURE 1—A graphic comparison of a one mile north offset, an offset eight miles to the northwest, both drilled with mud, and the Donahue Federal 1 drilled with air. Note the decreased penetration rate in the Donahue 1 at 4000 feet when the circulating system was changed to mud.

Air Drilling Sets Record in New Mexico

Fifty percent faster penetration with only 58 percent as many bits makes air drilling a worthwhile practice in hard formation.

By PECK REAVES, Frontier Drilling & Production Company
and **BILL BACHMAN,** Drilco Oil Tools, Inc.
Midland, Texas

THE BEST THING that can happen to a drilling contractor these days is to cut drilling time on a well in half. Air drilling makes this possible with a little luck in dodging water sands.

Best Run in Area. In the area 25 miles northwest of Carlsbad, New Mexico, Frontier Drilling and Production Company have just completed Donahue Federal No. 1, at a depth of 4500 feet for Standard Oil Company of Texas in record time. This is a wildcat in arid country, where water is an expensive problem and lost circulation even a greater financial burden. The country is well adapted to air drilling even on a wildcat basis.

For comparison purposes, Figure 1 shows the drilling rates of location A one mile north of the Donahue, and location B eight miles northwest of the record well. Both of these locations are recent holes and drilled with mud.

The contractor drilling location A used relatively light bit weight for this area, 35,000 pounds, and much of the hole was 12¼ inches. This would make the drilling somewhat slower than a smaller hole size, but it was included in this comparison because it was very close to the record hole and the drilling time difference is

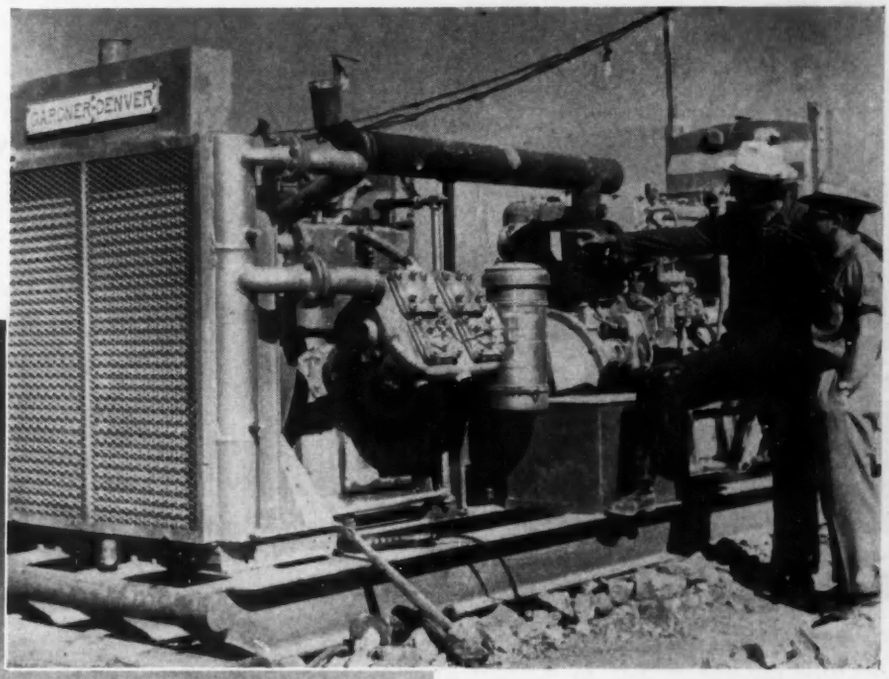


FIGURE 2—The air compressor hookup on Frontier's Donahue 1. These compressors are rented from a service company when air drilling is feasible. The service company provides an operator for the compressors who also assists rig personnel in air drilling problems.

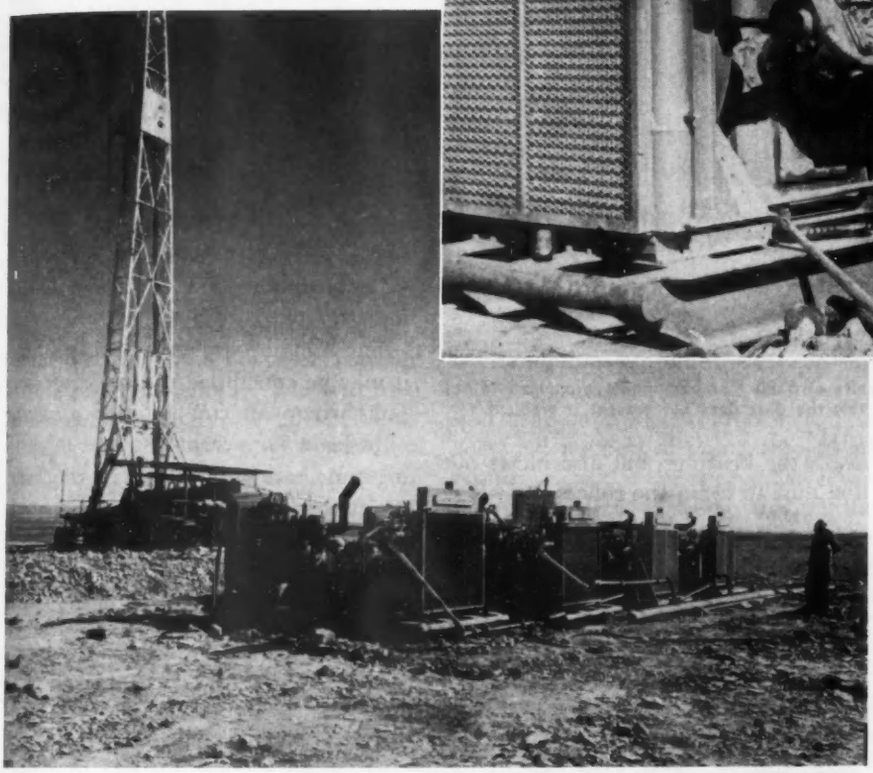


FIGURE 3—The compressors are specially built positive displacement, two-stage units with 200 horsepower gas engine drive. These compressors are rated at 525 cfm at 350 psi.

amazing. This hole required 615 rotating hours to 4427 feet and used 65 bits. The average rate of penetration was 7.2 feet per hour.

Location B is the other extreme, however. Unusually heavy weight of 80,000 pounds was run on the bits and most of the section was 8¾-inch hole. This hole required 441 rotating hours and used 43 bits to reach 4473 feet. Average rate of penetration was 10.1 feet per hour. Crooked hole did not prove to be a problem on any of the holes. Stabilizers were used extensively on location B to assist the drilling operation in case the hole began to drift.

Frontier's hole was drilled to 4500 feet in 297 rotating hours with 25 bits at an average rate of penetration of 15.2 feet per hour. This rate is 50 percent faster than location B, and only 58 percent as many bits were used.

Drilling Problems. In drilling the Donahue hole the first problem arose with gravel at the surface and from 550 to 700 feet. This gravel sloughed badly. A thick water sand was encountered at 650 feet. This water was estimated to be flowing at the rate of 10 barrels per hour. In order to overcome both water and gravel, it was necessary to use 7- 525 CFM compressors to keep the hole clean. The surface casing was set at 845 feet and no further water was encountered to total depth.

Air was used to 4065 feet when the hole was mudded up to test prospective pay at 4400-4500 feet. The drilling rate was immediately cut in half as a result of the mud. This is apparent from Figure 1.

In this general area, lost circulation is a major problem on the surface hole. A number of times there were no returns with the air. The passing of cuttings and air into caverns presented no particular problem.

Compressor Equipment. The compressor or hook-up (Figure 2) was secured from a service company complete with personnel to maintain the compressors and assist the rig personnel in the use of air circulation for drilling. The 11-inch surface hole was drilled to 845-feet with seven air drilling compressors delivering 525 cubic feet per minute each for a total of 3675 cubic feet per minute of air. The compressors used for this hole are specially built units for air drilling, see Figure 3. The compressors are positive displacement two-stage units with 200-hp gas engine drive. Each compressor unit is a self-contained package with its own power, drive, cooler and manifolding. The units are equipped with air coolers to insure that the air temperature will not damage the rotary hose, swivel packing or other components of the rotary rig. Also, the temperature of the air must be low to eliminate a refinery action if an oil-bearing formation is penetrated. The compressor has a top discharge pressure of 350 psi. The circulating pressure for drilling the dry section of the surface hole was 70 psi. After water was encountered the circulating pressure increased to 160 psi. At intervals water was pumped into the air stream at the surface to overcome "balling" of the bit. The annular velocity in the surface hole was 6700 feet per minute at the flow line.

In the 7⅞-inch hole only three

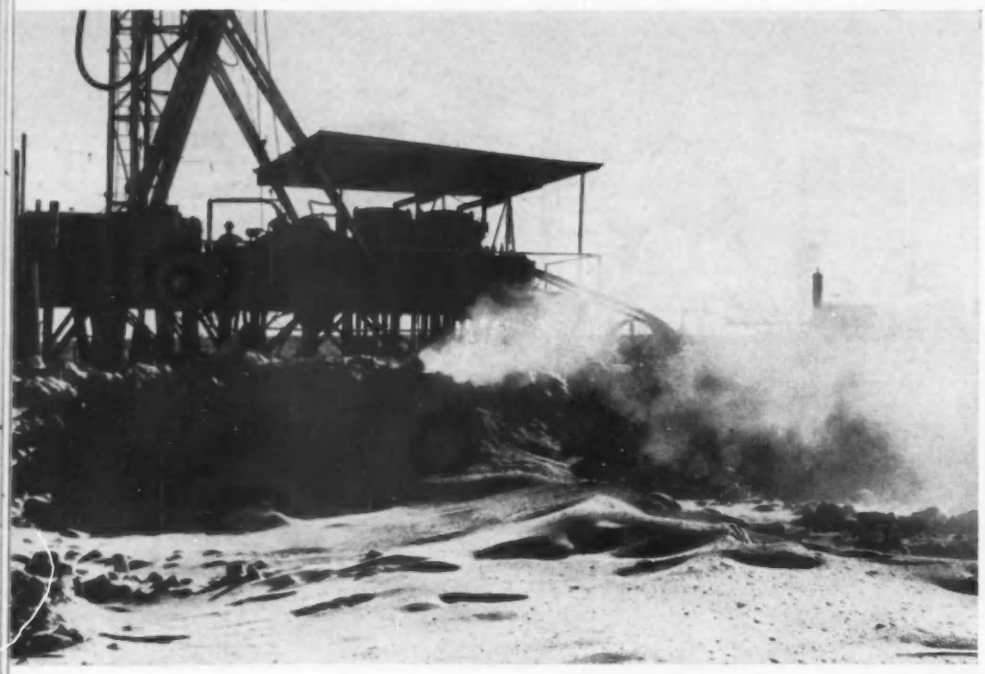


FIGURE 4—Dust and cuttings at an annular velocity of 6550 feet per minute are piped to the reserve pit. On an isolated location such as this the dust does not present a problem.

compressors were required to provide an annular velocity of 6550 feet per minute at the flow line. The circulation pressures in this section, from 845 to 4050 feet, were 60 to 90 psi.

The flow line was piped to the reserve pit as shown in Figure 4. A water spray has been devised to reduce the dust in the air in populated areas; however, as this location was so isolated, the dust presented no particular problem.

Rock Bit Problems. When air drilling in abrasive sections, keeping the hole in gage and overheating of the bit can become a major problem. The bits apparently continue drilling at a fast rate although they may be quite dull by standards used in conventional mud drilling. For instance, the first bit in the 7⅞-inch hole lost a cone due to excessive gage wear but only after an excellent run of 205 feet in 12½ hours. The hole was badly out of gage and more cones were lost from a second bit during reaming. In each case the bearings seemed to have locked, possibly from becoming too hot in the hole. Some of these dulls are shown in Figure 5. The rotary speed was reduced from 90 to 50 rpm and the trouble ceased. The higher RPM would have probably been permissible if special air drilling bits had been used. These bits have air passages through the bit legs to the bearings in the cones. This air not only cools the bearings, but also blows out the dust to clean the rollers.

Drill Collar Assembly. The drill collar string assembly consisted of two 7-inch OD drill collars on bottom, a rubber stabilizer and eighteen 6-inch drill collars on top. Today the use of only two large diameter drill collars on bottom with the smaller collars above has become popular practice in the Permian Basin. This provides the minimum of large collars in the hole in case of trouble and still affords excellent stabilization and stiffness just above the bit.

The chance of excessive hole deviation was reduced by the pendulum effect of the two 7-inch drill collars and rubber stabilizer. The rubber stabilizer has fairly good abrasive resistance properties when used in air drilling. On this hole two rubber sleeves were used in the 7⅞-inch hole to total depth. This is an average of ten trips per rubber sleeve.

Summing up the record on this hole, it may be concluded that in those sections where air can be used a saving of at least 50 percent or more in drilling time can be attained in the hard rock country even over extremely heavy weight mud drilling.—**The End**

FIGURE 5—Peck Reaves, superintendent for Frontier and co-author, inspects three of the dull bits used up in air drilling.

Solve Your Own Unit Pumper And Prime Mover Problems

Here are the suggested basic calculations for the selection of the proper size Unit Pumper and Prime Mover. Both the beginner and the experienced hand will find them useful.

By **TOM H. FRASER**
Continental Supply Company,
Dallas

The methods and formulae presented here are those proven to be easy to use, reasonable and well founded, and safe for average pumping problems. Many variations from these procedures are practiced by specialists in application of production equipment—and with good reasoning and proof to back-up their use. This presentation is not intended to provoke argument but rather to provide a sound application technique for use by inexperienced personnel on which they may build, as their experiences and observations warrant. The application of the bottom hole pump and sucker rod was covered in Part 1 of this article published in the November issue of WORLD OIL. (Solve Your Own Pump & Rod Problems.) Frequently reference will be made to the data and results from Part 1 without details being repeated.

THE CORRECT size and type of bottom hole pump and the correct sucker rod string have been selected previously. The correct bottom hole pump was the one having the smallest bore, a reasonable length of polished rod strokes, considering the arbitrary pumping unit selected, and operating at a reasonable number of strokes per minute with reference to the proper pumping speed curves previously discussed. The proper sucker rod string was the one giving the lightest weight and having a capacity within the load requirement range.

In the procedure outlined in Part 1 the weight of the Fluid Column to be lifted by the pump plunger and the sucker rods was calculated—this was called the Weight of the Fluid. In order to select the proper size of unit pumper, there are two common procedures: One is to take the weight of the fluid and multiply it by one-half of stroke length of the unit pumper arbitrarily selected. This can be expressed in a formula as:

$$\text{TORQUE NECESSARY IN REDUCER} = \text{Wf} \times \frac{\text{Stroke}}{2}$$

This formula gives a direct reading on the torque capacity necessary in the gear train. It is obvious that this formula is based on the premise that all of the rod weight will be counterbalanced—thus leaving only the fluid weight to be lifted. Through the above formula you have selected a unit pumper having the proper gear capacity, but it may be lacking in counterbalance effect available. It is, therefore, necessary that a check be made to determine whether or not the selected pumper does have the required amount of counterbalance. The accepted method of doing this—is to require that the pumper have counterbalance effect available to equal the weight of the sucker rods plus one-half of the weight of the fluid. This can be expressed by:

$$\text{COUNTERBALANCE EFFECT NECESSARY} = \text{WT Of Rods} + \tfrac{1}{2}\ \text{WT of Fluid}$$

If the size of the unit pumper selected from the torque formula does have counterbalance effect available equal to that required in the above formula, then the selection is correct. Should the unit pumper selection not have the required amount of counterbalance, then it is necessary that the next size larger unit pumper be applied.

This method of sizing the unit pumper is recommended for wells of medium and deep footage where the pump plunger size is not over 1½ inches. If the plunger size exceeds 1½ inches, then it is recommended that the Weight of Fluid be multiplied by 1.5, for use in the torque formula—the counterbalance effect remains the same as above.

The other popular method of sizing the unit pumper is expressed as:

$$\text{TORQUE RATING NECESSARY IN REDUCER} = [\text{Peak Polished Rod Load} - (\text{Effective Weight of Rods} + \tfrac{1}{2}\ \text{Weight of Fluid})] \times \frac{S}{2}$$

PART 2

This formula also gives a direct reading of the torque capacity required in the gear train. The counterbalance effect required in the application is identical, except for a variation necessary which is governed by the plunger size. If a plunger of 1½ inches or less is used, the above formula is correct, but if a 1¾-inch or larger plunger is used, then we should change the "½" Fluid Weight figure in the Torque Formula to "¼" Fluid Weight. This is based on the concept that fluid is difficult to counterbalance, because its load is imposed on the upstroke but not on the downstroke—thus as the ratio of the Fluid Weight to Rod Weight becomes greater, the amount of counterbalance effect possible to be applied becomes less. This fact should be considered when applying equipment to water source wells for water flooding, or to wells where a high volume of water must be handled in order to secure the oil.

There are several other application methods in use, but it is this author's opinion that the methods given above are best from a fundamental standpoint and also from an experience standpoint.

We now have selected the bottom-hole pump, the rod string, and the unit pumper. All that remains to be selected is the prime mover. It should be recognized that the power required in the prime mover bears no relationship to the size of the unit pumper selected. The only fact governing the power required in the prime mover is—what Weight of Fluid is to be

lifted from what depth? The torque capacity of the pumper selected, the weight on the polished rod, and strokes per minute are of no real concern to the prime mover. Some confusion exists because the term torque is used both in the gear formula and also in the prime mover data, but actually they are not the same animals.

If it is desired to calculate the horsepower required at the bottom hole pump—this is commonly called Hydraulic Horsepower—then resort to the basic formula horsepower.

$$\text{HYDRAULIC HORSEPOWER} = \frac{(330) \times (N) \times (D)}{(1440) \times (33{,}000)}$$

where

330 = Pounds per Barrel of Fluid
N = Production per Day @ 100% in Barrels
D = Depth of Pump Setting
1440 = Minutes per Day
33,000 = Foot Pounds per HP per Minute

The hydraulic horsepower calculated by the above formula is that required at the bottom of hole, and must be increased with reference to the power required in the prime mover due to friction between rods and tubing, friction in the stuffing box, friction in the unit pumper, and friction in the V-belt drive. In most cases, it is safe and reasonable to assume 50 percent efficiency between the prime mover and the bottom-hole pump, thus the above figure can be doubled in order to decide what power is necessary in the prime mover. The horsepower requirements are based on theoretical 100 percent production of the pump and bear no actual relationship to the amount of production actually secured.

From experience, several short cuts have been found to be safe for use in calculating horsepower required in the various types of prime movers. The formulae to be given below are safe and reasonable.

(1) HP Needed in Single Cylinder Gas Engine

$$= \frac{(N) \times (D)}{85{,}000}$$

(2) HP Needed in Electric Motor

$$= \frac{(N) \times (D)}{65{,}000}$$

(3) HP Needed in Multi-Cylinder Engine when modified from manufacturer's curves due to continuous duty application

$$= \frac{(N) \times (D)}{65{,}000}$$

At this point, all of the principle parts necessary to pump an oil well have been selected. We still have not selected the V-belt drive to connect the prime mover to the gear reducer. This presents two problems—first, selecting proper sheave size for drive ratio to give satisfactory prime mover speeds—and second, selection of proper length of V-belts to give satisfactory center-line distance between the reducer sheave and the prime mover sheave. To find the correct size of prime mover sheave, we have to multiply the strokes per minute times the gear ratio times the pitch diameter of the unit sheave and divide that sum by the desired RPM of the prime mover.

This answer will give you the exact pitch diameter required, but the exact size is very seldom available. The proper procedure is to refer to one of the V-belt manufacturer's catalogues and select the PD of the listed stock size that is closest to the exact PD indicated by the above formula. Attention must always be given to the determining of the proper bore and keyway size so that the prime mover sheave can be fitted to the output shaft of prime mover properly. The above calculation can be shown in the form below:

$$\text{P.D. of Prime Mover Sheave} = \frac{\text{SPM} \times \text{Gear Ratio} \times \text{PD of Unit Sheave}}{\text{RPM of Prime Mover}}$$

You will find that the PD of the sheave on the gear reducer is specified by the pumping unit manufacturer in most cases.

The next problem is that of belting the prime mover sheave to the gear reducer sheave. It is necessary to first determine the desired center distance between these sheaves. This can be done in two ways—first by referring to manufacturer's data on unit pumpers, you will find that most of these set forth a maximum and minimum distance in inches, and second, the distance can be found by measuring the unit pumper itself. Once you have determined the center distance in inches, then the formula below will give a very close result, indicating the belt length necessary:

$$\text{BELT LENGTH} = (D + d) \times 1.57 + 2C$$

D = diameter of large sheave in inches
d = diameter of small sheave in inches
C = center to center distance in inches

You will find that very seldom will V-belts be available in the exact length indicated for the above formula. You should select the nearest standard V-belt length from a manufacturer's catalog, then using the length make the following calculations to determine the center distance using that length of belt:

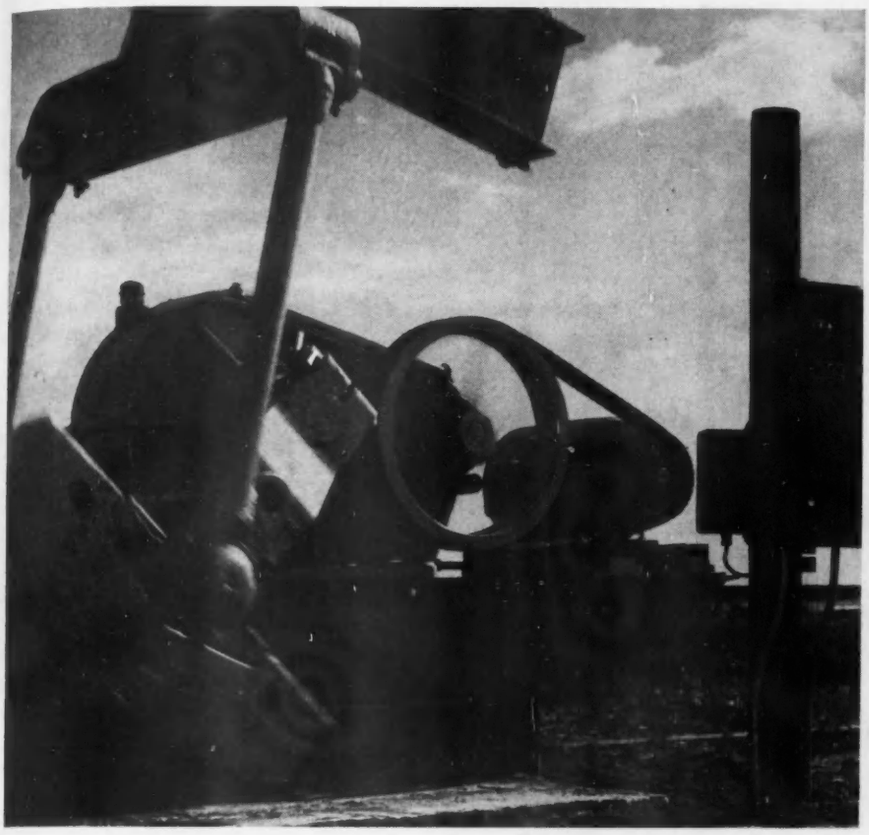
$$C = \frac{BL - (D + d) \times 1.57}{2}$$

All of the equipment necessary for installation of equipment necessary to produce fluid from a sub-terrain reservoir has been selected and connected. The equipment selected for application by the formulae given in the articles will in certain cases be too large and in some too small. For the average producing well, the equipment selected will be adequate. For the reader's convenience a complete summary of the formulae set forth in both parts of this article is presented below.

SUMMARY OF RECOMMENDED CALCULATIONS

1. Production = "P"
   $P = (S) \times (SPM) \times (Constant)$
2. **Static Rod Weight in Air = "W_{RA}"**
   W_R = (Wt. per foot) × Depth to Pump)
3. **Effective Weights of Rods = "W_R"**
   $W_R = (7/8) \times (W_{RA})$
4. **Weight of Fluid = "W_F"**
   W_F = (Wt. per foot on Plunger) × (Depth)
5. **Peak Polish Rod Load = "PPRL"**
   $PPRL = W_F + (W_R \times F)$
6. **Impulse Factor = "F"**
   $$1 + \frac{S \times (SPM)^2}{70{,}500}$$
7. **Stress = "PSI"** = Pounds per square inch.
   $$PSI = \frac{PPRL}{Area}$$
8. **Torque Size of Unit Pumper = "T"**
   $T = W_F \times \frac{S}{2}$ for 1½" Plungers, and Smaller.
   (1)
   $T = 1.5W_F \times \frac{S}{2}$ for 1¾" Plungers, and Larger.
   $T = [PPRL - (W_R + \frac{1}{2} W_F)] \times \frac{S}{2}$ for 1½" Plungers, and Smaller.
   (2)
   $T = [PPRL - (W_R + \frac{1}{4} W_F)] \times \frac{S}{2}$ for 1¾" Plungers, and Larger.
9. **Counterbalance Necessary = "CB"**
   $CB = (W_R + \frac{1}{2} W_F)$
10. **Horsepower = "HP"**
    (a) HP CSCO =
    $$\frac{\text{(Production @ 100\%) (Depth)}}{85{,}000}$$
    (b) HP Electric Motor and Multi-Cylinder Engine =
    $$\frac{\text{(Production @ 100\%) (Depth)}}{65{,}000}$$

—The End



Electrified beam pumping installation showing neat, compact arrangement of motor, controller and capacitor at pump jack.

Why the Trend Toward Electrified Leases?

Will electrification fit your lease? Here are some of the factors that make electrification attractive.

By J. H. DAY
General Electric Company,
Dallas

LEASE ELECTRIFICATION IS definitely established in most areas today. During the next few years, increased production requirements, the expansion of secondary recovery methods and lease automation will cause a tremendous surge of new installations. Yours may be one of them, so it might pay you to be familiar with the system.

The principal components in any lease electrification system are: the incoming line, usually 12,470 volts to 13,800 volts; the distribution transformers, to step down from primary voltage to utilization voltages, usually 480 or 240 volts; (Figure 1) the primary and secondary conductor, usually ACSR cable strung overhead; the motor controller, to start and stop the motor either manually or automatically on some preselected time cycle basis; and the motor, which drives the pump jack. In addition, other components usually are required, such as transformer protective devices, poles and pole line hardware, and capacitors for power factor improvement. Another item might be added, which would be layout and installation practices, including such things as size and type of poles, pole spacing, grounding and termination practices.

Since the producer or lease operator normally must buy and install them, let us discuss each of these components separately—that is, the distribution transformer and its protective devices, the conductor, the motor controller, the motor and capacitors.

Distribution Transformers. As mentioned before, the power company will supply power to the lease—generally at one location—at the primary voltage, usually 12,470, 13,200, 13,800 or 14,400 volts, although the power company may offer either primary or secondary power contracts to the purchaser. The choice then is an economic one with the power rates, lease configuration, and desired secondary distribution being the chief considerations.

If primary power is purchased, it is then necessary to step-down or "transform" this primary voltage to the utilization or secondary voltage. Since voltage drop or line losses increase appreciably with lower voltages, the secondary runs obviously should be kept as short as possible consistent with good economical practices. Therefore, depending considerably upon lease configuration, well spacing, and horsepower sizes involved, it is generally advantageous both operation- or engineering-wise, and economically to extend the incoming line or primary run to several step-down transformer banks over the lease.

In fact, because of the comparatively low operating power factor on most leases (due to the cycling nature of oil well pumping loads), it has been proven that 30 and 45 KVA distribution transformers are the most economical choices for the majority of cases, particularly where capacitors are used. In general, this means a "load center principle of power distribution, whereby power at primary voltage is brought directly to the load area where it is stepped down to utilization voltage and then distributed to the individual motors or loads over short secondary feeders.

There are in use today in the oil

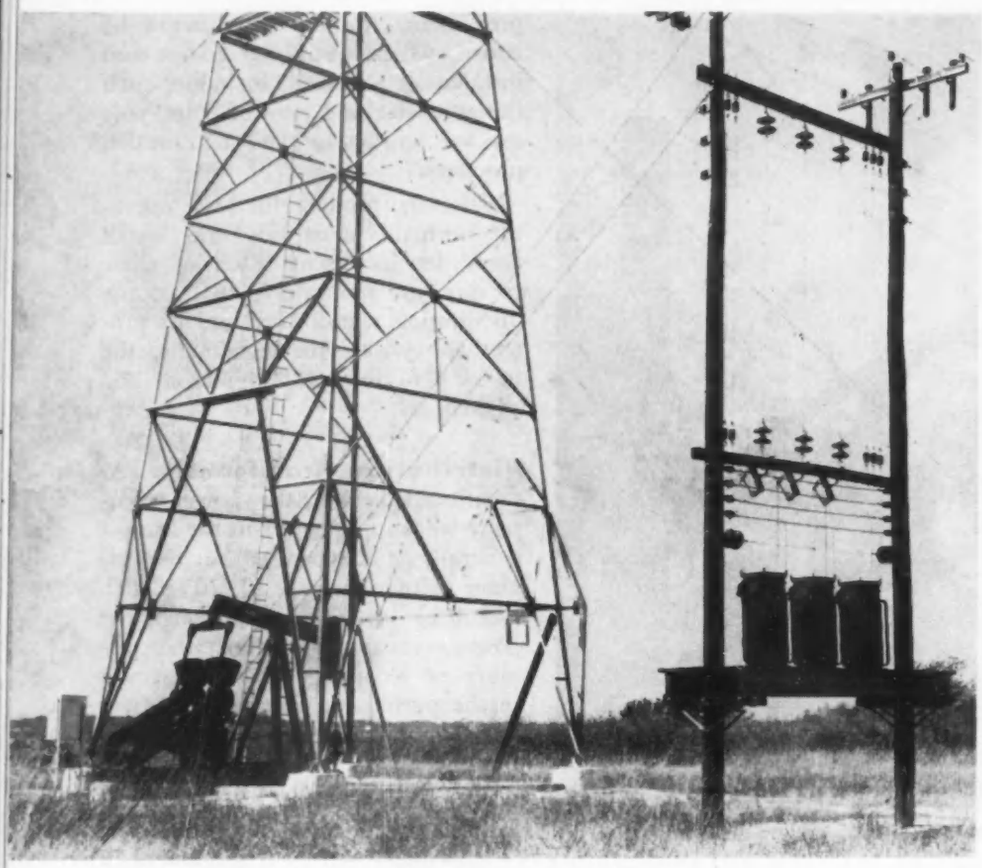


FIGURE 1—Step-down of primary voltage to utilization voltage at the well location.

fields two types of distribution transformers: banks of three single-phase transformers, and the 3-phase self-protected type. These are shown in Figure 2. The 3-phase self-protected type transformer is generally to be preferred because of its superior protection and lower installed costs.

As shown in Figure 3, the 3-phase self-protected transformer is complete with 3-valve-type lightning arresters mounted on the tank, internal hi-voltage fuses, 3-pole internally-mounted low-voltage circuit breakers with external operating handle, overload signal light and overload reset device. The cost of 3-phase self-protected transformers in the 30 and 45 KVA ratings are less expensive than three single-phase conventional units of the same bank rating plus separate fused cutouts and arresters.

And, of course, the single-phase bank would not include the secondary circuit breaker, signal light, reset device, etc., which provide coordinated overload protection for the 3-phase unit. Also, it is obvious that savings in cross arms, pole hardware, connections, and installation labor would further favor the 3-phase self-protected transformer.

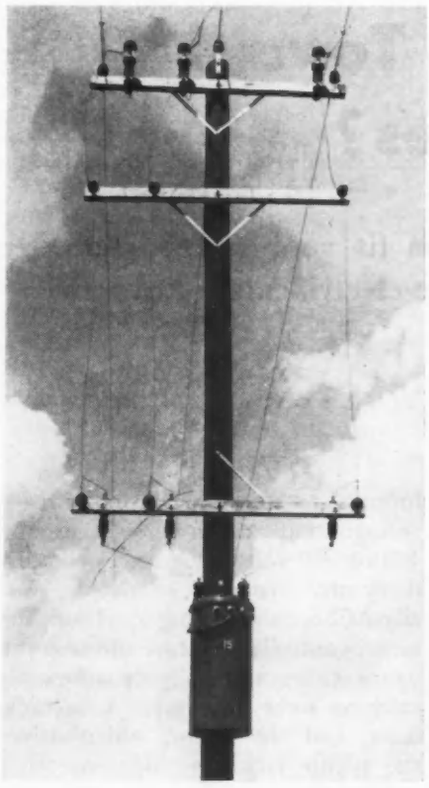


FIGURE 2A—A three-phase, self-protected transformer. The type generally preferred because of its superior protection and lower installation cost.

Up to the past three or four years banks of three single-phase units have been used primarily because of power company practice due to prevalence of single-phase loads on their distribution systems, and to the fact that it is possible to operate "open-delta" on two transformers and still carry about 58 percent of the 3-phase bank rating. However, due to the extremely good operating record of 3-phase distribution transformers, the engineering and operating facts support the further extension of their use in the oil fields.

Banks of single-phase transformers have traditionally been connected delta-primary-delta-secondary, in order to avoid the necessity of installing a third overload element in the motor starter, as is recommended for wye-delta or delta-wye transformations. However, in the 30 and 45 KVA ratings, 3-phase self-protected transformers connected wye-delta with the third pole overload element added to the starter are less expensive than delta-delta connected units.

In addition, oftentimes the primary power system is grounded permitting the use of wye-connected transformers with less expensive line-to-ground

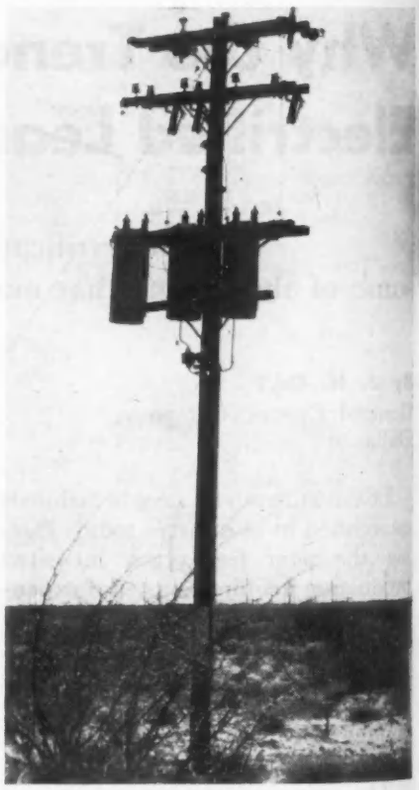
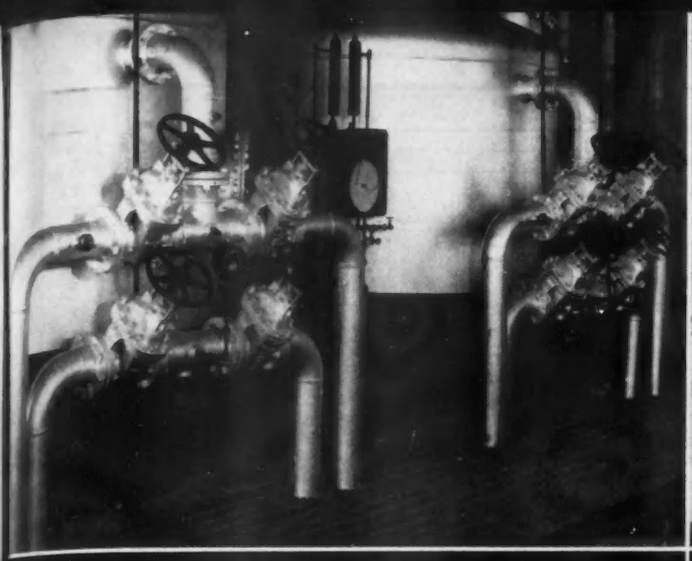


FIGURE 2B—A bank of three single-phase transformers. One of the two types of distribution transformers in general use in this oil field.



2-8′ x 5′ 40 PSI W.P. National Filters in Illinois Water Flood

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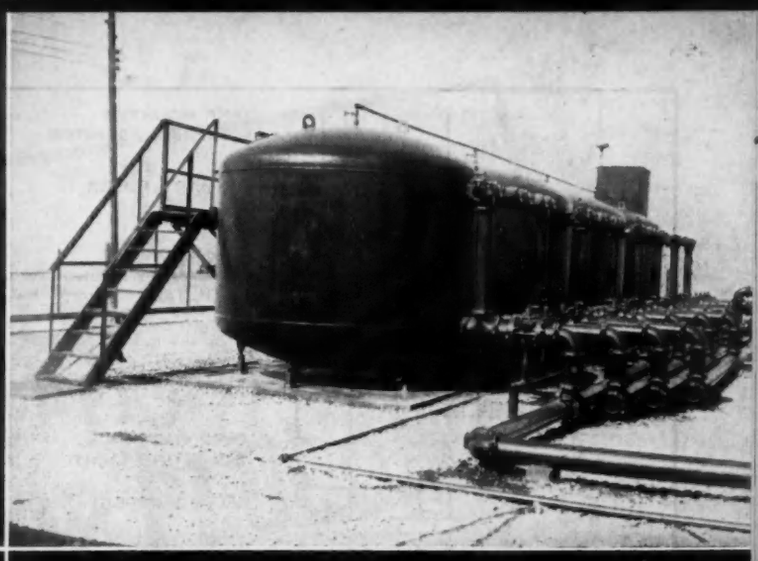
4-8′ x 5′ 60 PSI W.P. National Filters in gasoline plant near Schuler, Arkansas



8-75 PSI W.P. National Filters in Eastern Oklahoma Water Flood

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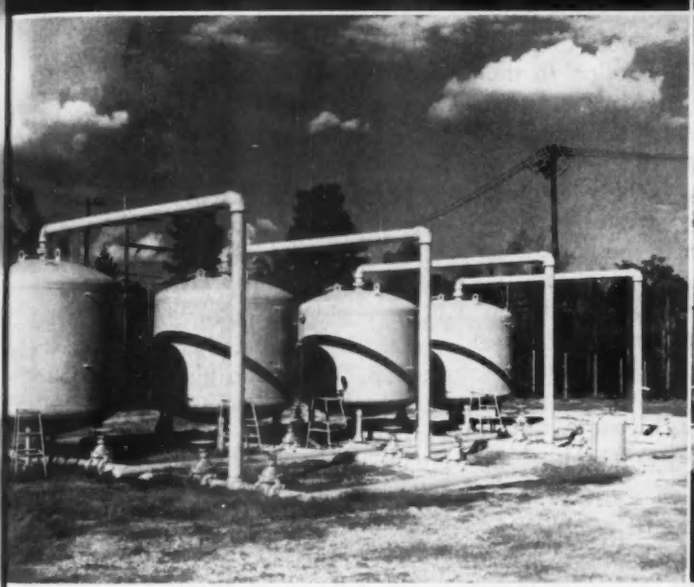
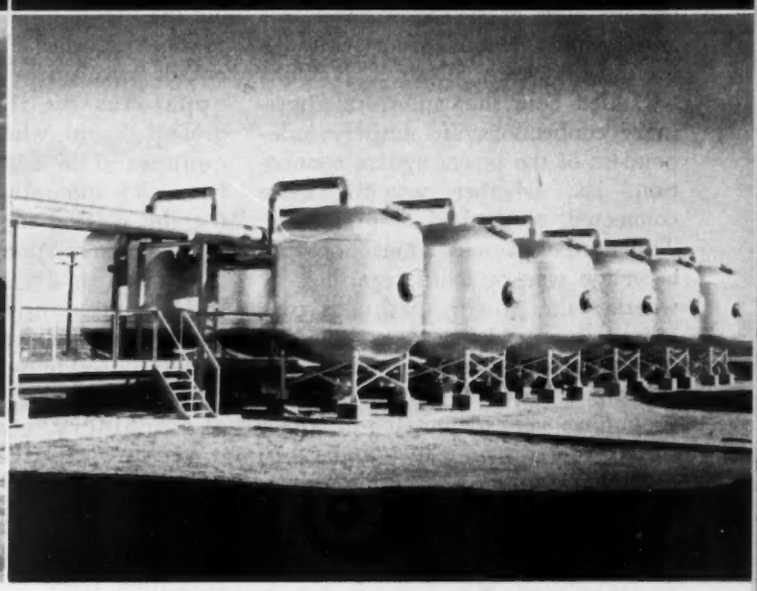
Battery of 200 PSI W.P. National Filters in West Texas Water Flood





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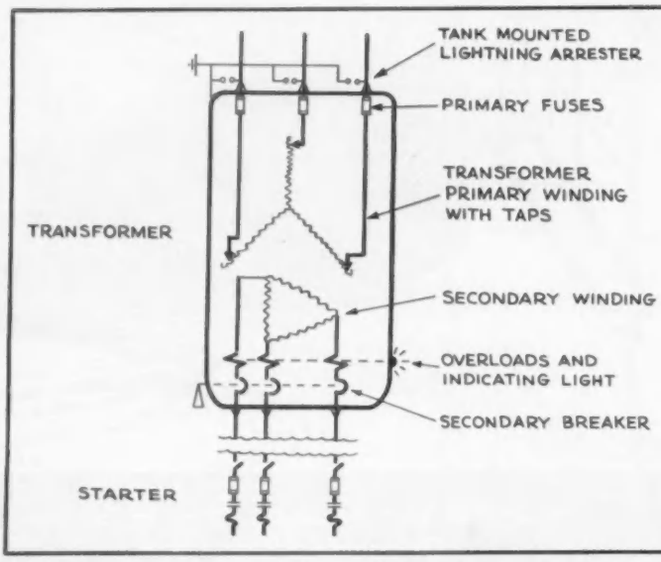

FIGURE 3—Schematic diagram of three-phase, self-protected transformers showing internally connected devices including lightning arresters, fuses, circuit breakers, signal light and reset device.

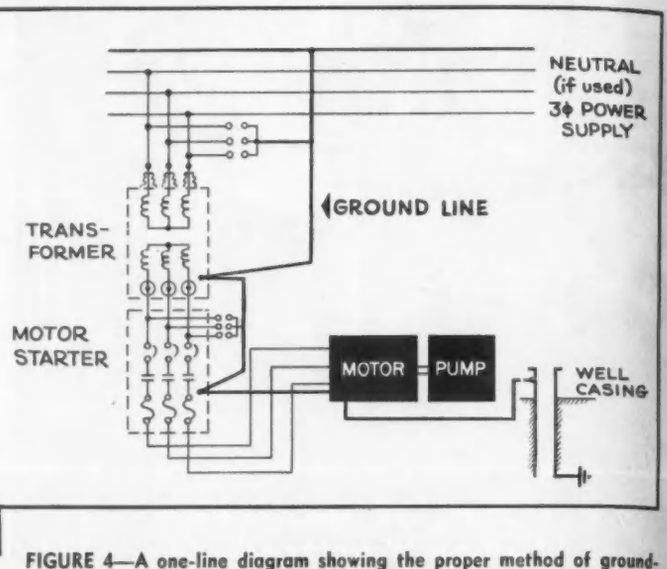

FIGURE 4—A one-line diagram showing the proper method of grounding to obtain the maximum protection to the apparatus involved. In dry areas particularly, the ground connection should be made to the well-head or casing preferably by welding-on.

voltage class of lightning arresters and primary cutouts than with ungrounded systems. However, it might be stated here that transformer primary connections are entirely independent of the power system connection, i.e., whether wye or delta connected, or method of grounding. Transformer primary connections can be made wye or delta regardless of whether the power system is connected wye or delta, or is grounded or ungrounded. However, the power system connections and system grounding very definitely do affect the transformer protective apparatus, such as lightning arresters and primary cutouts, as to voltage class or rating required.

Single-phase transformers in sizes 50 KVA and below and three-phase transformers in sizes 45 KVA and below are suitable for direct-pole mounting, without the use of crossarms. Larger sizes up through 100 KVA can be made suitable for direct-pole mounting with the use of pole adapter plates. This method of mounting is suggested for use whereever possible, as direct-pole mounting has the following advantages:

1. More secure and rugged mounting of the transformer on the pole.
2. Eliminates the expense of buying and stocking crossarms, crossarm hangers and crossarm hardware.
3. Affords more flexibility in locating primary and secondary leads.

Lightning arresters should always be provided with a reliable low-resistance ground connection, keeping the line-to-ground discharge path as short and direct as practicable. To obtain maximum protection to the apparatus the lightning arrester ground should, where practicable, be connected in with the grounded frames of apparatus being protected, thereby placing the arrester in electrical shunt relation to the apparatus insulation. In dry areas particularly, the ground connection should be made to the well head or casing preferably by welding-on, rather than to grounding rods, frames or bed plates of machinery, etc. Figure 4 demonstrates the proper method of grounding.

Use of Capacitors. In establishing a distribution system for lease electrification there are certain criteria which should be observed in order to gain optimum efficiency and economy of operation. These are:

1. The total voltage drop for the system should not exceed 15 percent maximum.
2. A voltage of not less than 95 percent of rated nameplate voltage should be maintained at he most distant motor from the transformer during running and not less than 80 percent during starting.
3. System over-all power factor should be maintained higher than 80 percent.

One way to minimize voltage drop is to install over-size transformer banks and larger conductor sizes than required. A better, more economical method is to minimize system losses. This can be done by:

1. Maintaining good voltage level on the system, both primary and secondary by adjusting transformer taps if necesary.
2. Keeping secondary runs as short as possible.
3. Use of capacitors to improve system power factor.

The use of capacitors will reduce considerably the line current by supplying excitation or magnetizing current to the motors; thereby reducing the I^2R losses; and thereby permitting smaller size transformers to be used. If located at the motor starter (to be switched with the motor), they will also allow smaller size conductor to be used. As a matter of fact, actual field tests have indicated a conservative 25 percent reduction in actual line current using capacitors.

Normally transformers are sized to the load on the basis of one KVA per horsepower. With capacitors of the proper size installed at the motor, however, the transformers sizes required can be determined on the basis of ¾ KVA per horsepower. This represents conservative practice, and with proper diversity factor of the loads factored in the KVA per horsepower ratio may be safely figured even lower.

In summary, the addition of capacitors in the proper sizes to the system will have the following desirable effects:

1. A 25 percent reduction in transformer sizes.
2. A 44 percent reduction in secondary losses (I^2R losses).

IN

WATER FLOODING OPERATIONS

STOP PLUGGING

due to SCALE
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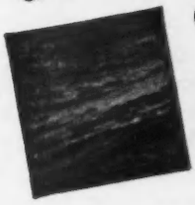

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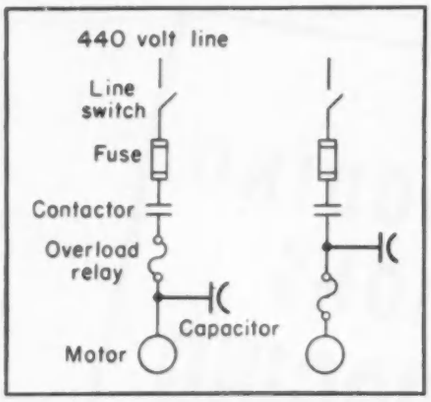

FIGURE 5—Motor line circuit showing alternate means of mounting capacitor. Capacitor installed ahead of overload relay (right) is preferable as it allows standard size overload heater elements to be used.

3. Direct savings in power bills, particularly if a power factor clause is involved and enforced.

4. An approximate 25 percent reduction in secondary voltage drop.

It is to be emphasized that generally speaking capacitors are an economical consideration whether or not a power factor penalty clause is involved in the power contract. Because of the reduction in I^2R or heating losses, capacitors will normally pay for themselves in two years or less—perhaps within six months if a power factor clause is enforced. But not only will capacitors save money on power bills, they will also allow smaller equipment to be purchased (or more load to be safely added to existing transformers and feeders), will give better torques and operating characteristics for the motor, and will also afford some degree of lightning protection to the equipment by reducing the steepness of the wave front.

The oilfield capacitor has been developed in a weather-proof box for outdoor installation at or near the motor. They are available in ratings from two through six KVAR at 460 volts. In order to allow maximum effectiveness and reduction in line size, capacitors should be connected as close to the motor as practicable. However, usual practice is to mount the capacitor on the stub pole with the motor starter. Preferably the capacitor should be connected between the line contactor and the overload relay, in order that the overload relay heater elements will not have to be changed, as they would if located on the line side of the capacitor. The arrangement will also allow the capacitor to be switched with the motor to provide a disconnect means and also to give the right amount of power factor correction when the load requires it. The methods of mounting the capacitor are shown in Figure 5.

To prevent possible voltage failures due to overexcitation or shaft breakages due to transient torques, capacitors should not be applied to induction motors in excess of recommended ratings.

Oil Field Pumping Controller. The essential requirements of an oil field controller are:

1. Construction-wise it must be suitable for oilwell pumping service located outdoors, exposed to snow, rain, dust storms and the hot summer sun.

2. It must protect itself and the motor against lightning and primary single-phasing in addition to the normal hazards of short circuits, overloads, undervoltage, etc.

3. It must be suitable for performing its duties unattended and to automatically start and stop the pump on some preselected time schedule.

As shown in Figure 6, basically an oil field controller consists of eight separate devices or functions. These are:

1. The fused disconnect switch or line circuit breaker for short circuit protection and to safely disconnect the incoming power line from the starter.

2. The line contactor for starting or stopping the motor by making or breaking the source of power.

3. The overload relay to trip out and open the line contactor on high currents caused by overload, single-phasing, unbalanced voltage, etc.

4. The lightning arrester to protect the starter by safely discharging lightning surges or strikes on the line.

5. The undervoltage relay to give positive protection against low voltage conditions or single-phasing.

6. The program time clock to enable a planned or programmed pumping time period to be automatically adhered to.

7. A sequence restart timer to automatically stagger the restarting of the wells after a power failure to prevent excessive inrush current from being imposed on the transformer bank and distribution system.

8. The HAND-OFF-AUTO selector switch permits either manual (attended) or automatic (unattended) operation to be set up and maintained as desired.

In addition to the necessary features of safety, outdoor construction, ease of installation and maintenance, the oil field controller must function with a maximum degree of protection and reliability. To accomplish this, the following operating practices are recommended:

1. A reliable ground connection should be made, preferably to the well-head or casing by solidly welding on. The lightning arrester grounding stud, starter case or enclosure, and motor frame should all be properly connected to this common ground.

2. To assure maximum protection to motor on overload, low voltage, and single-phase conditions, particularly if a wye-delta transformation is employed, it is recommended that a three-element overload relay be used instead of the normal two-pole type. This is especially desirable in starter, size 2 and larger (10 HP at 440 volts or larger).

Oil Field Pumping Motor. The motor most commonly used for oil well pumping service today is the high-starting torque, normal-slip, 1200 revolutions per minute, squirrel-

About the Author

JOHN H. DAY, JR., District Petroleum Specialist for General Electric Company, Dallas, Texas, did undergraduate work in electrical engineering at Southern Methodist University before being appointed to the U. S. Naval Academy from which he graduated with a B.S. degree in 1944. He joined General Electric in 1946 and after successfully completing assignments in Schenectady, N. Y., and Philadelphia, worked as design engineer in the Industrial Control Engineering Department in Schenectady.

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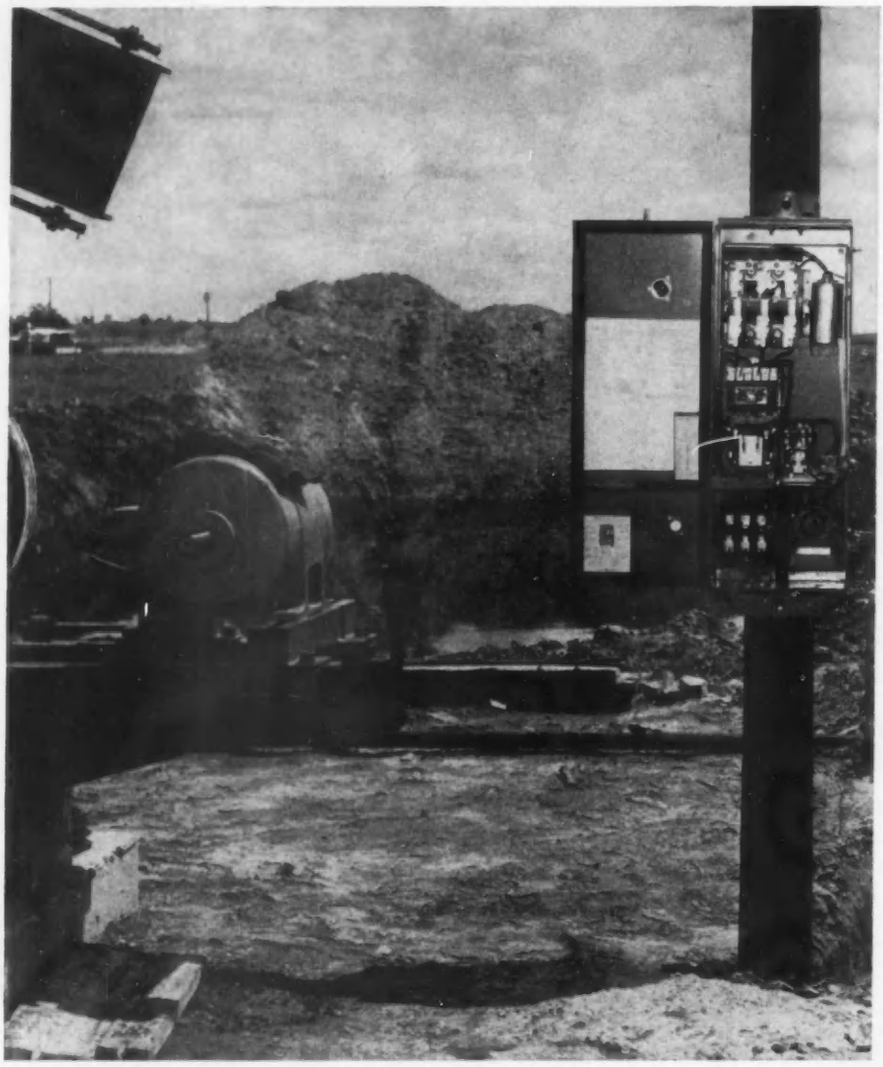


FIGURE 6—Front view of controller with door open showing devices necessary for completed protection and automatic operation.

cage induction motor. This motor, NEMA Design C, has proven to be particularly well suited to the peculiar cyclic beam pumping duty. Having a starting torque generally about 225 to 250 percent of full load running torque, this motor can be depended upon to break away and accelerate the load under the worst possible conditions of counterweighting and fluid viscosity in the hole. In addition the six-pole, 1200 rpm rating is easily adaptable to provide pumping speeds in the range of 15 to 35 strokes per minute by the proper application of sheaves on the V-belt drive.

The oil field pumping motor must be suitable for oil-well pumping both duty-wise and construction-wise. It must be suitable for outdoor service in a variety of atmospheres and climates—varying from hot, dusty locales such as the West Texas areas to moist or frigid locales such as North Dakota. In addition, the oil field pumping motor should be equipped with standard industry features, such as rodent screen, lifting-eye bolts, and ball bearings.

In the past the totally-enclosed, 55 degree rise and splash-proof 50 degree rise induction motors were commonly used for oil-well pumping service. Even today the totally-enclosed motor is to be recommended for service in severe atmospheres, such as corrosive gasses or salt water laden air. However, due to the tremendous progress that has been made by the electrical manufacturing industry during the past seven or eight years in the design and materials for electric motors, it is now common practice to use the standard open, dripproof, 40 degree rise induction motor for outdoor service in preference to the more expensive splash-proof design. Today most manufacturers of electric motors will propose and recommend their dripproof motor for outdoor use with the same warranty and service as for the splash-proof motor. In addition to first cost, the user has the advantages of more standard design, 1.15 guaranteed service factor, lower temperature rise for the same type of insulation, plus full cooling air flow through the motor.

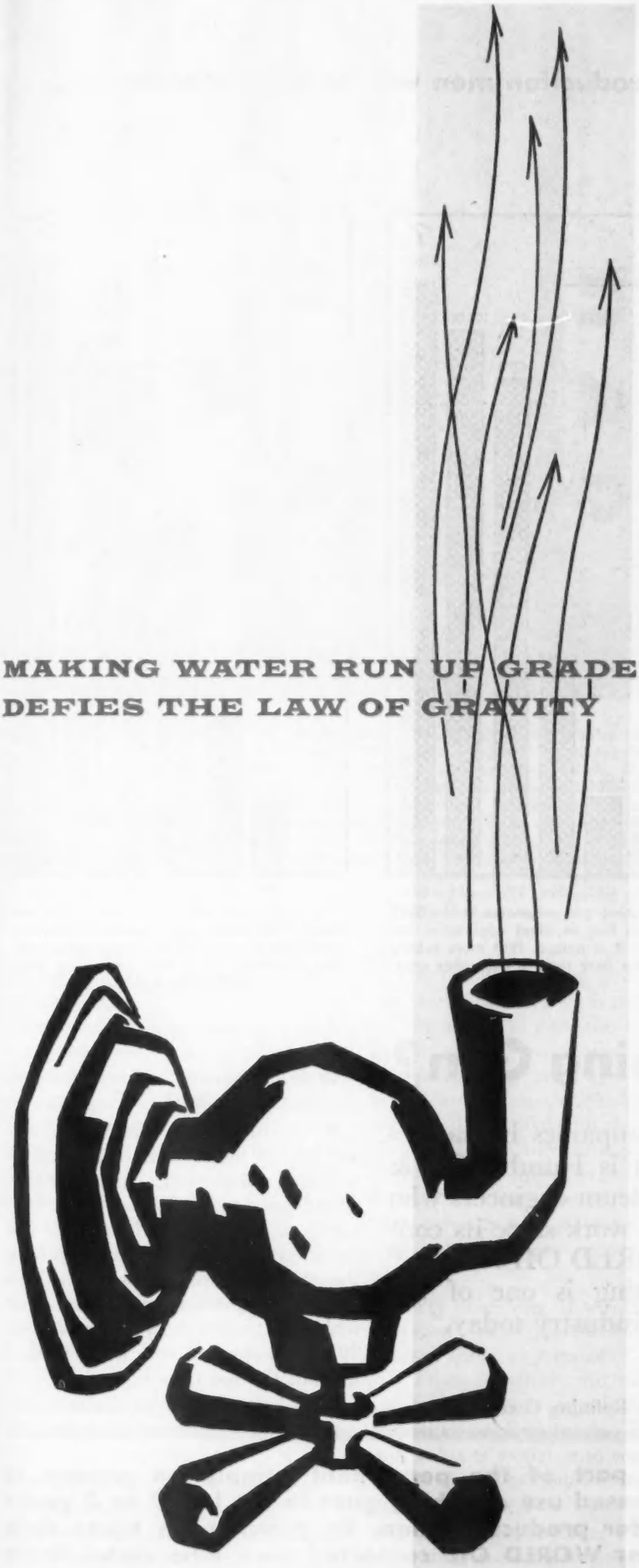
In addition to the high-starting torque, normal-slip motor, the high- or medium-slip, NEMA Design D, induction motor has also been applied to oil-well pumping. The characteristics of this motor are such that it tends to slow down or "slip" when increasing loads are applied suddenly, thus giving a cushioning effect to the mechanical system and also reducing somewhat peak currents on the power system. This latter characteristic would be particularly desirable if the lease is generating its own power from an engine-generator set, for example.

In lease pumping today, however, it is preferable, generally speaking, to maintain the flow or strokes per minute at the predetermined level—particularly when pumping under proration limits. Therefore, if the speed of the high- or medium-slip motor has to be increased to obtain the same pumping output or barrels per day, there is no appreciable gain in cushioning effect. Furthermore, actual field tests have indicated that it requires more kilowatt-hours of electrical energy to pump a given number of barrels of oil using high-slip induction motors than using normal-slip induction motors.

Multi-horsepower or triple-rated motors have been used extensively for oil well pumping, whereby the horsepower rating may be changed by reconnecting the winding delta, wye or wye-delta at the conduit box. This has been done where water encroachment has been a problem, or where the flow conditions of the well were expected to change requiring a larger ultimate horsepower size than that initially required.

Triple-rated motors are used primarily to afford improvement in power factor and efficiency. The triple-rated motor costs more initially than a standard motor of the largest horsepower rating, due to the internal winding connections required and to the large number of leads that

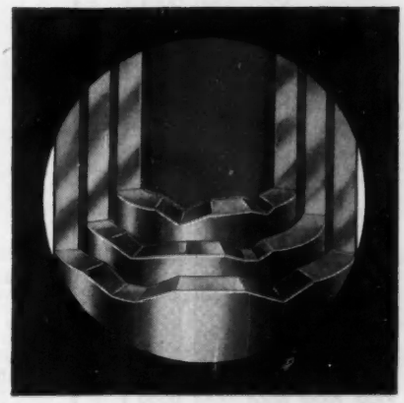
Continued on Page 185



MAKING WATER RUN UP GRADE DEFIES THE LAW OF GRAVITY

Lifting water in the oil fields presents a like problem—whether it be a water supply well for a flood or just a plain wet oil well.

Fluid Packed Pump Co., in recognition of the Oil Industry's need for a Down Well Rod-Drawn Pump that will economically and efficiently handle large volumes of water, has applied the Multiple Tube Principle to its design of an over-size pump. The Multiple Tube Pump, by reason of its sleeve type construction, will maintain its maximum rate of efficiency in water, and does not require lubrication for successful operation.



The fluid packing between the tubes eliminates the need for lubrication.

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SPECIFICATIONS

Pump Bore	Pump O.D.	Tubing or Casing Size	Bore Factor*	Maximum Stroke
2¼"	2¾"	3" or larger	0.590	166"
2¾"	3¾"	4" or larger	0.881	166"
3¼"	3¾"	4" or larger	1.232	166"
3¾"	4"	5½" or larger	1.640	166"

*BORE FACTOR X STROKE LENGTH IN INCHES X STROKES PER MINUTE EQUALS BARRELS PER 24 HOURS.
EXAMPLE: 1.640 X 74" STROKE X 15 SPM–1,820 BARRELS.

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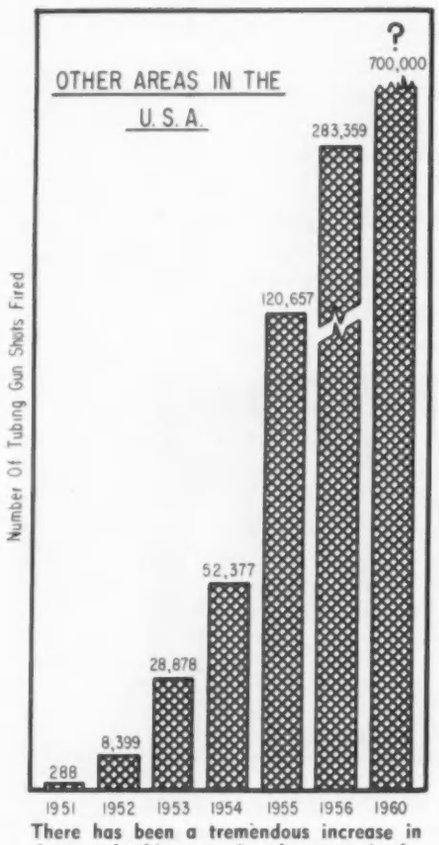
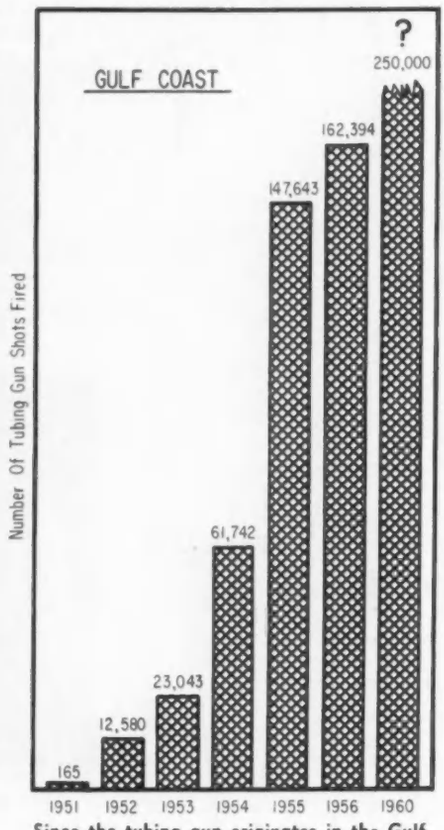
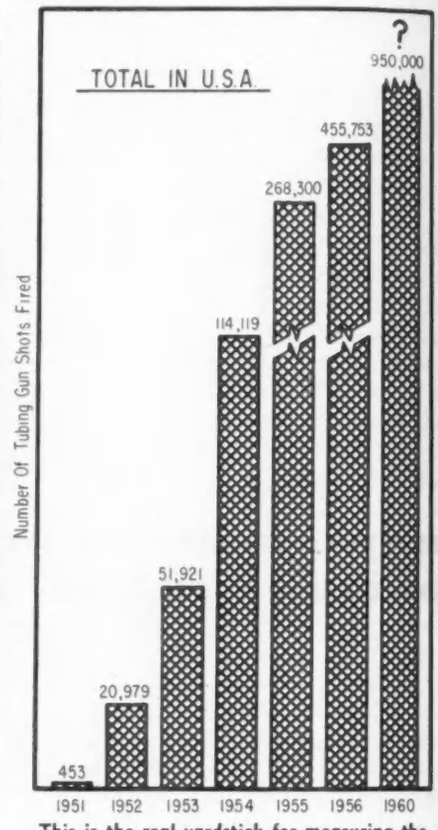
A WORLD OIL INTERVIEW production men will be interested in . . .



There has been a tremendous increase in the use of tubing guns in other areas in the U. S. Indications are that this increase will continue.



Since the tubing gun originates in the Gulf Coast, which has an ideal application for the process, it is natural that more tubing guns are shot here than in any other area.



This is the real yardstick for measuring the value of the tubing gun. Production men are putting it to work in ever increasing numbers. Perhaps it is the answer to your perforating problem.

Why Not Use a Tubing Gun?

The pioneer among oil companies in the development and use of the tubing gun is Humble Oil & Refining Company. One of their petroleum engineers who has been closely associated with P. C. work since its conception is G. H. Tausch who told WORLD OIL:

"Through-tubing perforating is one of the most effective perforating tools in the industry today."

An Interview with . . .
G. H. TAUSCH, Petroleum Engineer, Humble Oil & Refining Company

Q *What brought about the conception and use of the tubing gun?*

A The tubing gun was the first logical step in the method of permanent type well completion, which was conceived prior to the advent to the tubing gun. After the initial gun was designed, constructed and applied, then the remaining steps in the permanent completion process were dealt with. It was almost two years later in 1952 that the first well was reworked without the use of a rig.

Q *What was the immediate reac-*

Probably the most widely used part of the permanent completion process is through-tubing perforating. The increased use of tubing guns in the last 2 or 3 years indicates that they are useful tools for production men. To provide an up-to-date report on the progress of tubing guns WORLD OIL contacted men who make them —men who use them and men who don't.

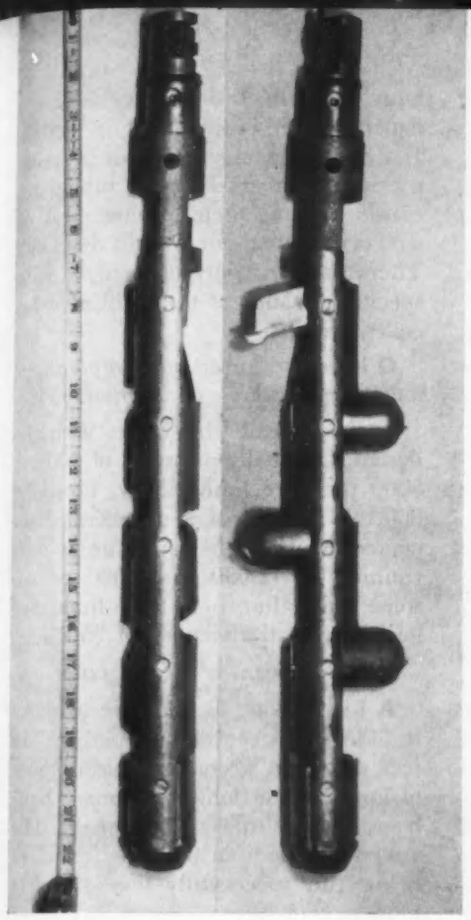


FIGURE 1—This version of the tubing gun has four large jet charges per foot. It travels through the tubing in the collapsed position illustrated at the right and extends the charges just prior to firing as demonstrated at the left. In the collapsed position its outside diameter measures 1¾ inches. Extended it measures 4⅜ inches. The gun has a maximum operating pressure of 13,000 psi and a maximum operating temperature of 300° F.

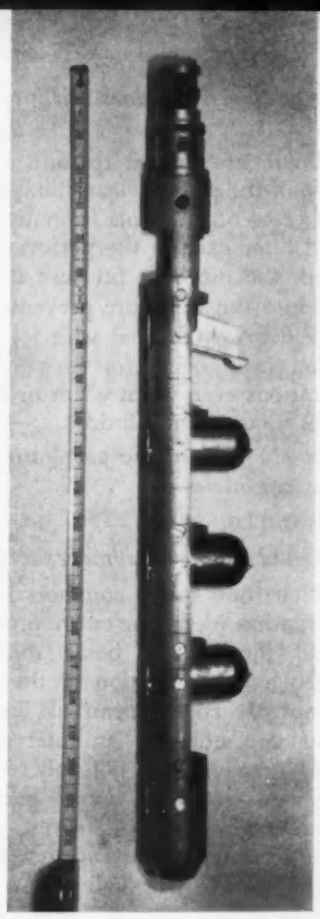


FIGURE 2—A variation of the design in Figure 1 has all the charges extending from one side. This reduces the diameter of the gun in its open position to 3⅛ inches, allowing it to operate in smaller diameter casing. All of the guns of this design have a built-in safety device which prevents their firing until the charges are at least 70 degrees from their closed position.

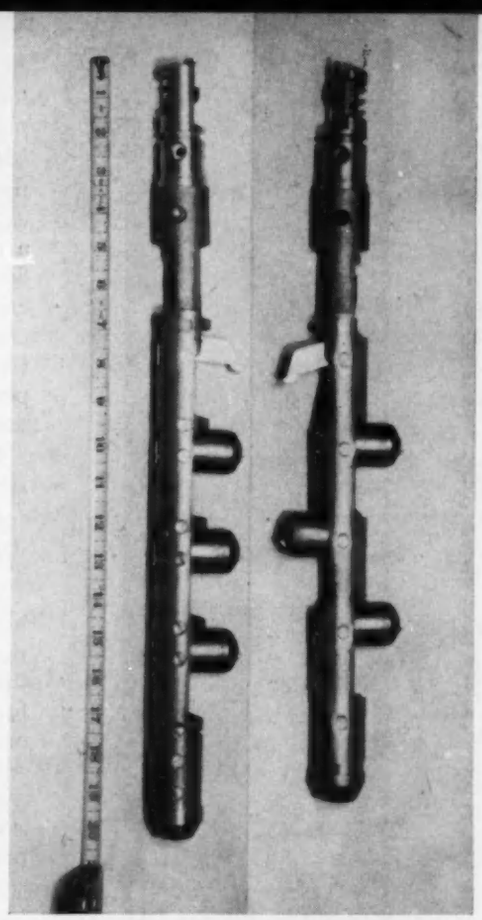


FIGURE 3—This 1⅜-inch outside diameter version of Figure 1 opens to 3¼ inches, as shown at the left. It operates at pressures up to 15,000 psi and may be fired from the top or the bottom as desired. With all the charges opening from one side, as illustrated at the right, the O.D. increases to 2⅜ inches.

tion to the tubing gun on the part of industry?

A The tubing gun was too novel, too new for acceptance by the industry at that time. After the initial perforating job in the Fall of 1950, only 8 to 11 wells were perforated by the end of 1951. It was nearly two years later before any quantity of tubing gun jobs were performed.

Q *Was much work done in the way of design during that time?*

A No, very little was done to improve the carrier or the jet charge until the acceptance of the idea by industry. The service companies were not idle, however, but were busy designing proper blowout preventers, stuffing boxes, lubricators and surface units.

Q *What caused this initial acceptance by industry?*

A The primary consideration was the dollars and cents angle. A considerable saving is afforded in rig time by the use of a tubing gun to perforate a well. Since a rig is not required to run a tubing gun, the tubing can be run and the rig moved off before the perforating operation is begun. When a well is perforated with a pressure differential into the wellbore, an indication of successful penetration is immediately apparent; often saving the rig time lost when it is necessary to reperforate with a casing gun.

Q *Was there any other consideration?*

A Yes there was. It was found that increased well productivity was brought about as a result of the clean well fluids in which the tubing gun was fired. This is especially true in bentonitic or dirty sands. There was quite a bit of evidence to support this even in the initial applications of tubing guns.

Q *Would you say that tubing gun perforating is now generally accepted by the petroleum industry?*

A That portion of the industry using jet perforating or drilling mud as a perforating fluid have found a definite application for the tubing gun through the elimination of a rig and plugging completion fluids. Those areas that may safely use a non-plugging fluid when perforating and customarily use bullet perforators may find the tubing gun more expensive when perforating long intervals.

Some Advantages of Tubing Guns

Q *As I understand it, permanent completion means—with the tubing and well-head set in place. What is the advantage of this in perforating?*

A This method insures a safe operation by keeping under control any formation pressures released through the perforations. To my knowledge there has never been a blow-out on a well using the permanent completion method.

Q *You mentioned clean fluids on*

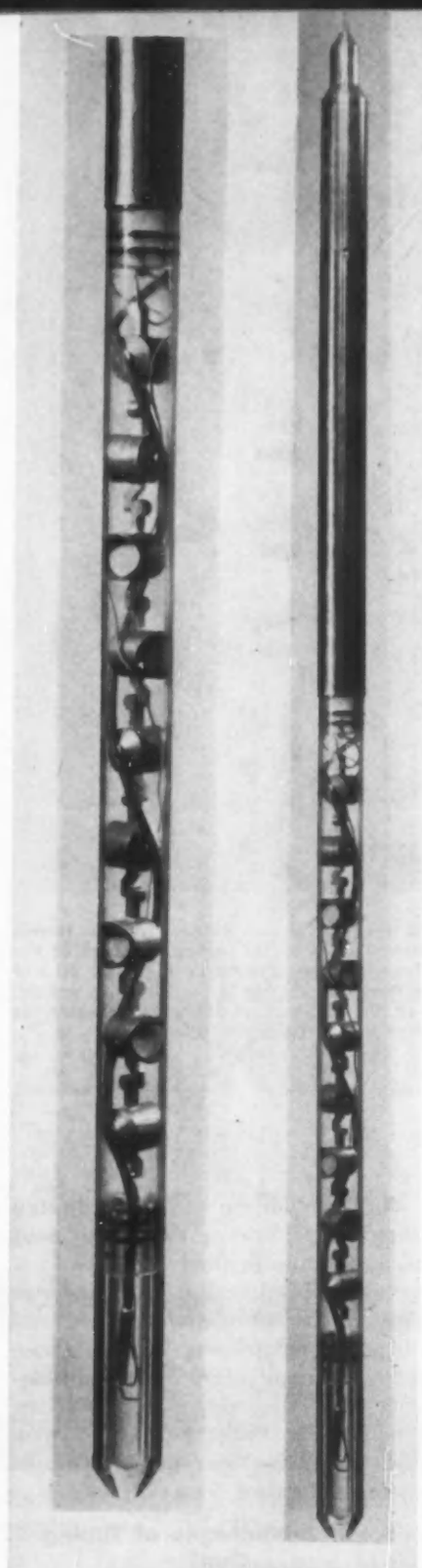


FIGURE 4—The aluminum tubes were replaced with transparent plastic to allow a display of the charge assemblies. The 2-3/16-inch model for use through 2½-inch tubing and the 1¾-inch O.D. model for 2-inch tubing, operate at pressures to 7000 psi. Pressures to 14,000 psi can be reached by use of a thin steel carrier for running in 3½-inch I.D. liners. These models fire 4 shots per foot at 90 degree spacing. To prevent premature ignition, resistors are in the electrical circuit and may be seen at the bottom of the models. This design incorporates considerable mechanical strength for handling, spudding.

the formation. Why does this increase productivity?

A There are several reasons. First, the use of the proper clean fluids such as water or oil prevents formation of a mud filter cake in the perforations. Second, the use of a pressure differential into the well bore prevents the charge debris associated with jet perforating from being forced into the perforations even when water or oil is used as a completion fluid.

Q *Is plugging of the perforations a serious consideration?*

A It can be.

Q *Could you give some examples?*

A Well, one fairly common result is a situation where the entire production of the well is being released through a small fraction of the perforations. It could mean as few as one or two holes in an interval of several feet. This may not only reduce production but, in some circumstances, might lead to a severe sand problem brought about by the excessive rate of flow through a few perforations.

Another problem that these mud plugs still present after production of the well shows up when you are squeeze cementing. The cement has a tendency to follow the line of least resistance going through the open perforations and not displacing the mud plugs. Pressure testing may indicate that the squeeze cement job was satisfactory, then later, tests creating a pressure differential into the well-bore blow out one or two of the mud plugs and a second cement job is necessary. This sort of procedure could be repeated several times before all the mud plugs have been removed and replaced with cement.

In most cases, the time and money involved in repeated cement jobs could have been saved if a clean fluid had been used in the well during the perforating operation as well as during the remedial operations. Permanent completion and the tubing gun make the use of water or oil in the hole, safe and effective.

Q *Just how effective are the tubing guns available today?*

A The penetrating ability of the available tubing guns is highly effective when used with a non-plugging perforating fluid. There are tubing guns that equal or surpass conventional casing guns in penetrating ability. The other properties of tubing guns that effect their successful use depend upon individual gun design. If additional flexibility or working pressure or small diameter tubing are considerations, then, tubing guns of different designs would be used. There are a variety of designs, with specific advantages that will give excellent results.

Q *What pressures and temperatures will today's tubing guns stand?*

A Once again this varies with the design. Originally pressures of 4000 to 5000 psi were limits. Now, however, 8000 to 10,000 psi is a generally accepted figure with equipment tests running to 12,000 to 15,000 psi on some units. Temperature limits are generally in the vicinity of 350° F.

Q *How long is a tubing gun?*

A Just as long as you care to make it. The average length is about 10 feet, however, a considerable number of guns 50 feet long and longer have been used in the last two years. The longest single gun I have heard of being run successfully was 120 feet long.

Q *Where are long guns applicable?*

A In situations where extreme pressures are expected after shooting a long interval making repeated entry into the well difficult.

Q *Are tubing guns harmful to casing?*

A Field tests indicate that they are not. Tubing guns fired under fluid in unsupported casing at depths up to 5000 feet showed practically no damage to the casing.

Q *Are there any other advantages to the use of tubing guns in conjunction with P. C. which you can think of at the moment?*

A Well, in addition to safety and well productivity, it allows you to test the perforating job immediately since the tubing and wellhead are ready for production. There is the smaller shooting line, because of the reduced gun weight, which can be used under higher pressure without excessive blow-by. These are a few of the more obvious advantages.

Q *Are the tubing guns in use today much improved over the first designs?*

A Yes, today's guns are much improved. The service companies and oil companies have worked together very well and there is now a variety of tubing guns available for specific

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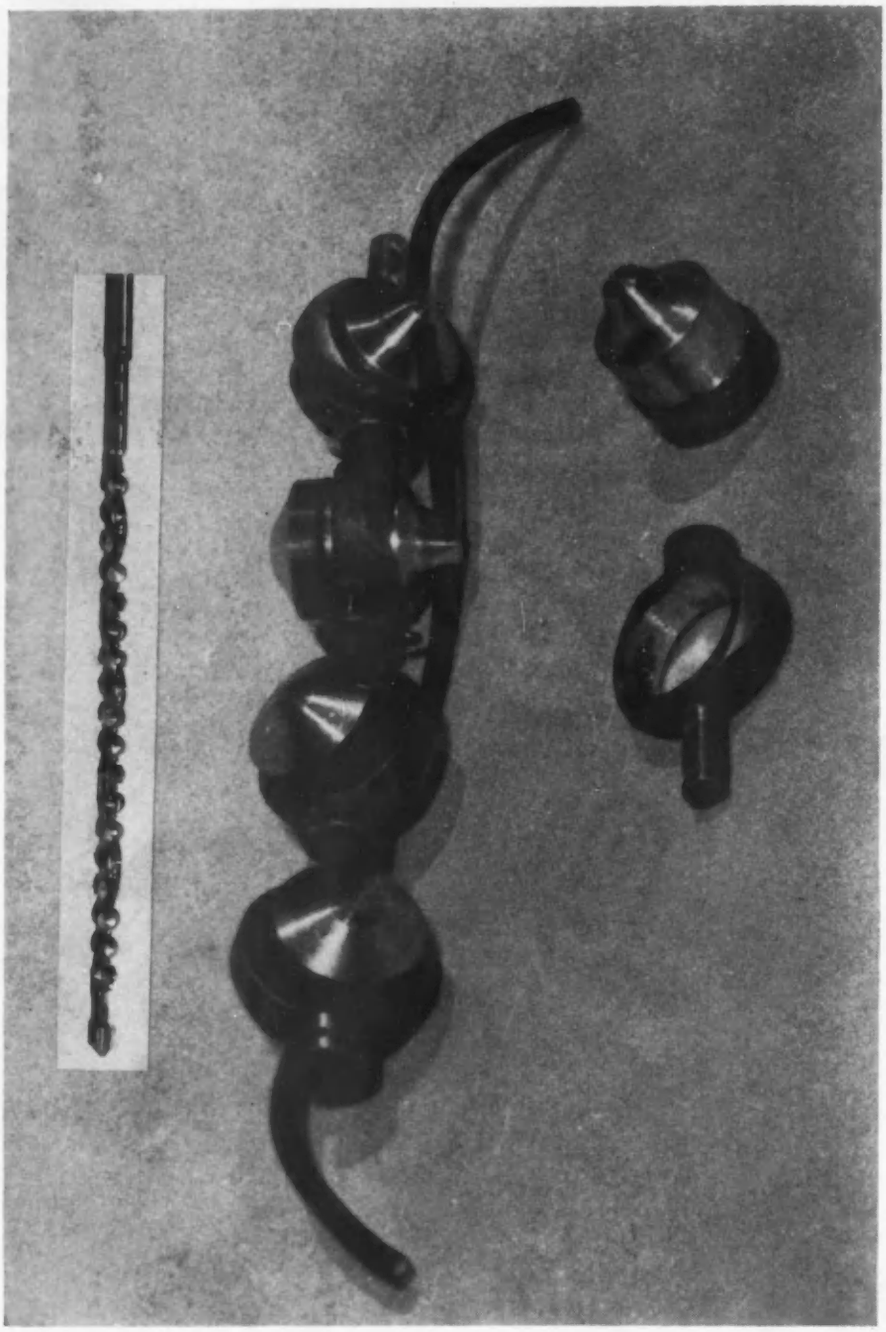

FIGURE 5—This tubing gun utilizes separate capsules for each jet charge. Firing either 5 or 6 shots per foot at approximately 60 degrees spacing, it works in pressures up to 15,000 psi and temperatures of 375° F. The gun illustrated here has a 1¾-inch O.D., however, a similar model with a 2⅛-inch O.D. will soon be available. In addition to having good penetration and hole size characteristics, this gun is very flexible. Since the aluminum carrier and the charge cases are cast the debris resulting from firing the gun is well broken up.

well conditions. During the last 12 months the design changes and improvements have been particularly noticeable. There is now a 1⅜ inch tubing gun for use in 1½ inch ID tubing as powerful as a conventional casing gun. The working pressures have been increased and the breakup of the guns is much improved.

Some Limitations of Tubing Guns

Q *When these tubing guns break up is there much of a debris problem?*

A Yes there is. In fact this is currently the major problem connected with the tubing gun. There has been a constant effort by most of the people concerned with design to reduce the quantity of debris and increase the breakup or frangibility of tubing guns. This reduction of gun debris, of course, must be balanced by the other physical requirements of the guns. One or two of the service companies in conjunction with metals manufacturers are nearing a solution; however, at present there is much room for improvement.

Q *What are some of the difficulties that result from the debris?*

A As I mentioned, the degree of breakup is very important. We have found a number of cases in the past where bridges have been formed in the casing by tubing gun debris preventing additional work in the perforating interval. Usually these bridges can be pushed below the perforations with sinker bars but occasionally we have to resort to a caustic or acid solution to remove them.

We also found it best to fill the well with a light fluid and close the flow line valves at the well-head. This prevents any surge of fluid from carrying debris up the tubing causing the retrievable collar locator and cable head to lodge on their return to the surface.

Then too, if the top zone of a dual completion is perforated with a tubing gun, there is always the problem of removing the debris from the packer between the zones.

Q *What are some of the other limitations of the tubing gun?*

A Here again you get into the design factor with each gun having specific advantages and limitations depending upon individual well conditions. There is one inherent feature, however, which they all possess to a degree—they are fragile. This necessitates more careful handling but doesn't offer any real difficulty for a trained crew.

Q *Are specially trained service crews required to run tubing guns?*

A No, the service companies give additional instruction to their regular crews which qualifies them to assemble and run tubing guns. Some of the guns are more flexible than others, some can be spudded, others can't, some are affected by debris in the well. The shooting crews are aware of all this and can be of real assistance to the operator.

What Can the Operator Do?

Q *How can the operator assist the service company personnel with through tubing perforating?*

A It's much the same as any other activity on a well. He should understand the operation and prepare his well to accommodate the necessary equipment. For example, probably the greatest difficulty encountered in the use of a tubing gun is getting it through the tubing. Therefore, the

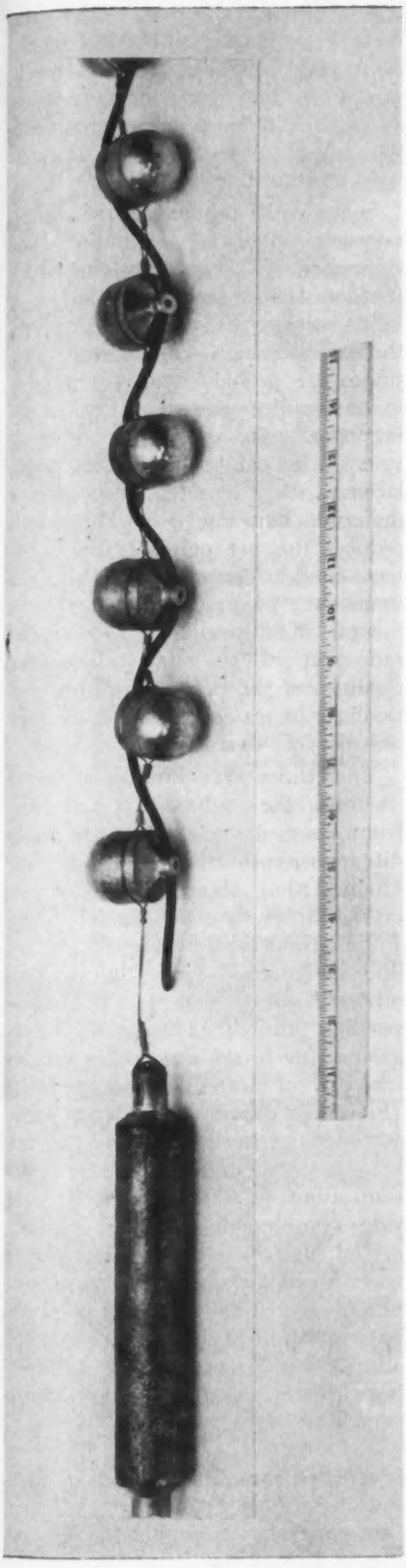

FIGURE 6—This design provides maximum flexibility and a near minimum of debris combined with good perforating qualities. The size of charge and number of charges per foot can be varied to almost any extreme. The smallest charges pass through 1¼-inch tubing while the largest measure about 4 inches O.D. The charges are clamped to fine wire at whatever interval the operator desires. A weight is used at the bottom of the string of charges to keep the wires taut during their descent.

tubing should be drifted prior to setting. Rust, mud, cement, debris, kinked tubing, these are all items that the operator can eliminate before he calls a perforating company to help make the job easy.

Q *How about having the shooting zone in the casing clean?*

A Yes, that's a part of well preparation, too. There have been occasions when an operator has circulated his well and cleaned the tubing thoroughly but left heavy mud or acid in the casing below the tubing. When the light weight tubing gun hit the mud it stopped and no amount of spudding could lower it to the zone to be perforated. Eventually the gun had to be withdrawn, and the mud removed, after which the well was perforated without any trouble.

In the case where acid was left in the hole, the aluminum gun was almost completely dissolved before it even reached the desired interval.

These cases illustrate the need for an understanding of the tubing gun perforating procedure on the part of the operator as well as the service personnel.

Q *Is it true that there are tubing guns capable of operating in acid?*

A As a matter of fact there is a plastic coating available, which, when applied to the aluminum guns will allow them to operate for a limited time in acid. By spotting acid next to the formation before the plastic coated gun is lowered, it is possible to pump acid into the formation immediately after perforating.

Q *Would you say that the tubing gun has been of any great assistance to the producer?*

A Definitely. I believe that it is a real contribution to the petroleum industry. It has introduced a means of perforating that is not only effective and economical, but has inherent advantages that tend to increase well productivity when utilized with the proper completion fluid. Of course there is always room for improvement and the evolution through which the tubing gun has gone is an indication of the progress being made. Perhaps the best yardstick, however, is the somewhat phenomenal increase in the use of tubing guns by industry. Yes, I'd say tubing guns are here to stay.

ACKNOWLEDGMENT

Photographs and specifications of the various tubing gun designs were submitted to World Oil by Go Oil Well Services, Lane Wells Company, Perforating Guns Atlas Corporation, Schlumberger Well Surveying Corporation, and Welex Jet Services Incorporated.

Electrified Leases

Continued from Page 176

must be brought out to the conduit terminal box.

With the advent of the oil-field capacitor for power factor correction and improvement of motor operating characteristics, triple-rated motors are not used today to the extent that they formerly were. In general, installing a motor of the largest or ultimate horsepower requirement together with a capacitor of the proper size costs less than a triple-rated motor and will give superior field operating results. Therefore, accepted practice in the oil fields today is to base horsepower size requirements on the ultimate well flow and depth conditions expected, and to install capacitors with the motor so selected.

Conclusion. It has been estimated that the system losses for the first year of operation of an electrified lease may amount to 15 percent of the distribution system first cost.

The motor and controller—representing the other third of the cost of electrification—are relatively fixed both in size and design; therefore, most of the system engineering considerations go with the distribution system, and it is here that most of the cost savings—both during installation and operation—may be realized. For the most economic design and over-all operation, system heating and excitation losses must be considered and accounted for. If, for example, savings in I^2R losses will pay for the next larger size conductor capitalized on a three year payout, then the larger conductor size should be purchased.

Other loss-savings and safety devices previously discussed such as capacitors, system grounding, and motor protective devices should also be considered strongly. The lowest priced system based on first cost alone is not necessarily the cheapest.

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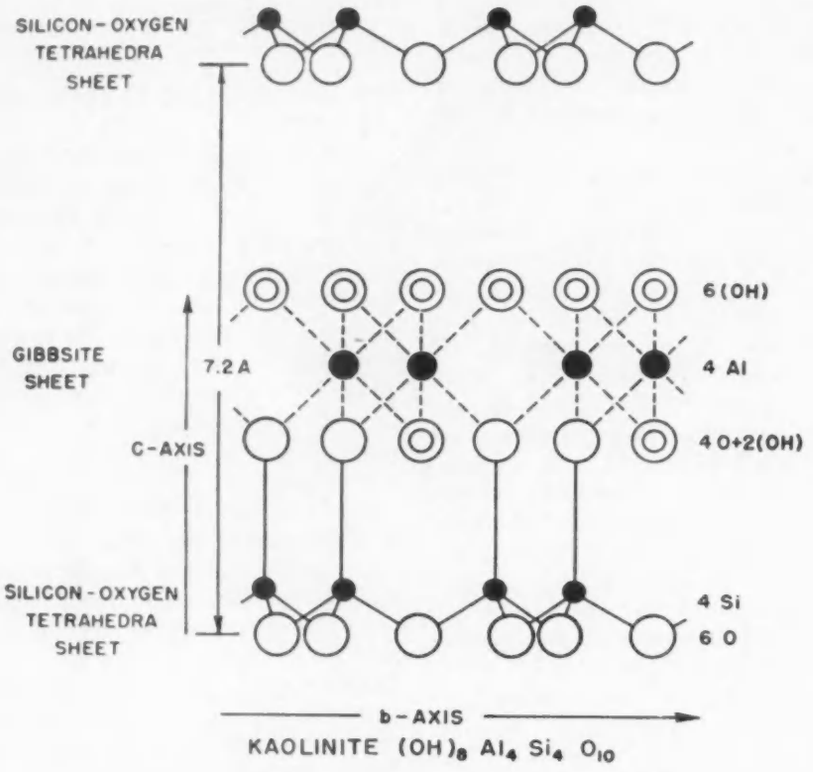

FIGURE 1—Schematic crystal structure of kaolinite.
(After Grumer, Grim,[3] Hughes.[2] Courtesy American Petroleum Institute.)

How to Identify Clay Minerals . . . and Why

Kaolinite, montmorillonite and illite are three types of interest in production from reservoir sandstones. Structure, identification and effect on production are important to you.

By JOHN F. NOONAN
Bureau of Mines, Appalachian Experiment Station
Morgantown, West Va.

THIS IS A BRIEF review of a more complete literature survey related to clay minerals and their effect on petroleum production. The survey was made prior to experimental work in the Division of Petroleum Technology, Region V, Bureau of Mines. The purpose of the review is to help more petroleum operators become familiar with the nature of clays and methods of minimizing the effect of water on water-sensitive sands.

The constituents of oil-bearing reservoirs are mainly sandstones, limestones and dolomites and are essentially sedimentary rocks. The clays and shales—sedimentary deposits of the very fine-grained materials—constitute about 80 percent of all sedimentary rocks.[1] In addition to the cementing or binding material itself, sandstones may vary in the amount and nature of solid matter present in the pores formed by the granular sand structure.

Some of the paramount petroleum-reservoir sandstone formations are comprised of "clean" sands in which the pore spaces are essentially free of solids, whereas, in other formations, the majority of the oil-bearing sandstones are probably "dirty" in some manner and degree. The intergranular pore spaces in the latter sandstones are partly filled with argillaceous, silty, lignitic, or bentonitic material. This solid matter not only reduces the net porosity and petroleum-fluid-holding capacity of the sandstone; but an even more detrimental effect would be the possible reduction of the fluid-transmitting qualities of the porous medium, particularly in water flooding in secondary-recovery operations.

The three clay-mineral types of interest in the production of petroleum from reservoir sandstones are kaolinite, montmorillonite, and illite. Hughes[2] has shown the schematic crystal structure of kaolinite (Figure 1), montmorillonite (Figure 2), and illite (Figure 3) from the work of others,[3,4] which indicate the relative swelling possibilities of the three clay groups due to the adsorption and retention of water. Montmorillonite (Figure 2) allows planar water to be adsorbed between successive silicon-oxygen tetrahedra sheets. The potassium atoms in illites (Figure 3) provide considerable bonding between crystal surfaces and allow less planar water to be adsorbed. The superposition of oxygen and hydroxyl planes in adjacent units of kaolinite (Figure 1) affords hydrogen bonding between layers; consequently, kaolinites adsorb very little planar water.

Identification. The methods of analysis utilized in determining whether clay minerals are present in oil-bearing sandstones and, if so, the type and amount present, are: Dye adsorption or staining, petrographic determinations, base exchange or ion exchange, differential thermal analysis, X-ray diffration, and electron microscopy. In staining methods of clay-mineral identification, the adsorption of various organic substances by clays can

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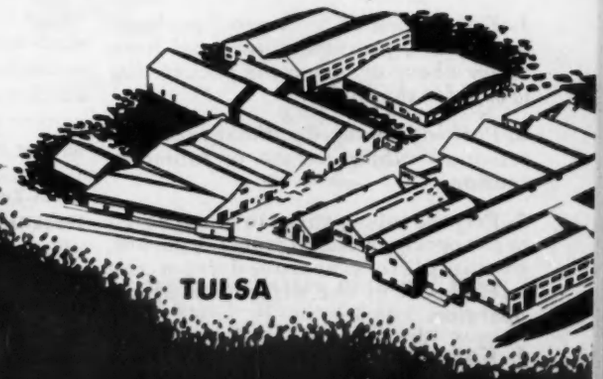

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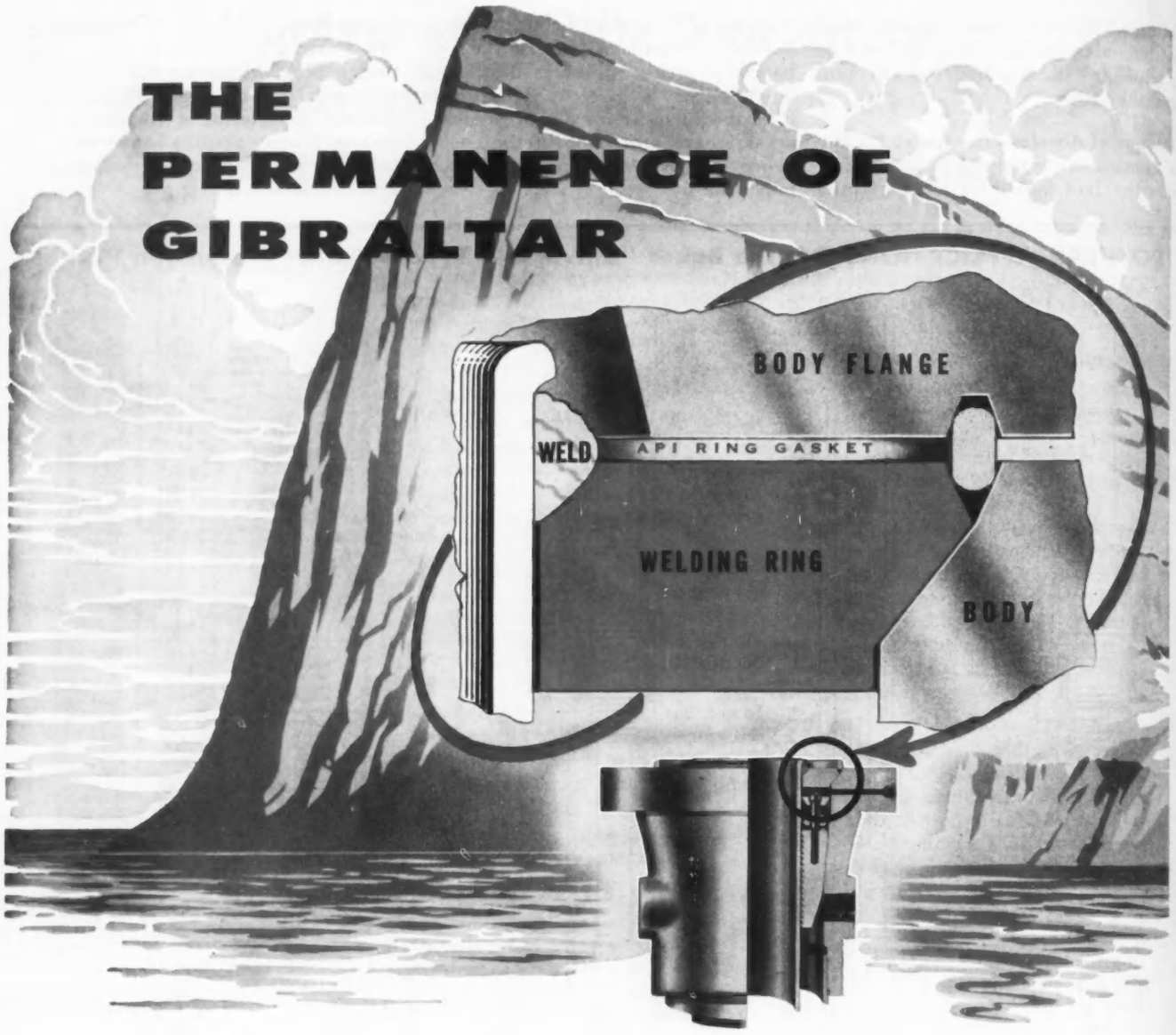

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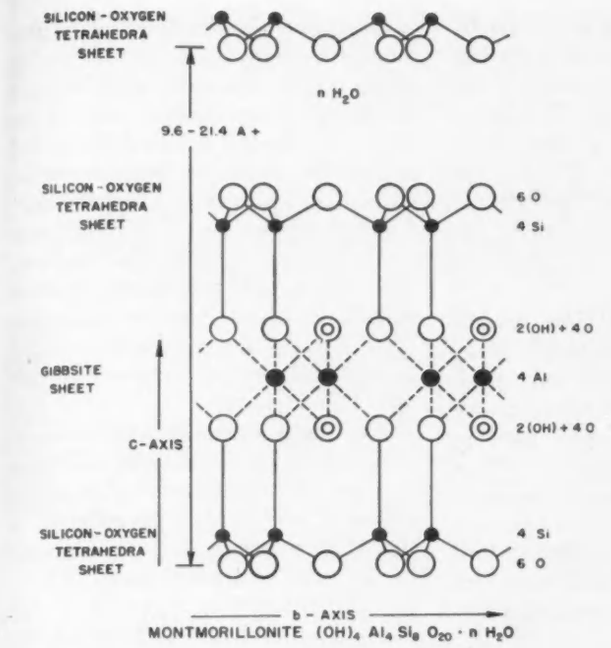

FIGURE 2—Schematic crystal structure of montmorillonite.
(After Hoffman, Endell, Wilm, Grim,[3] Hughes.[2] Courtesy American Petroleum Institute.)

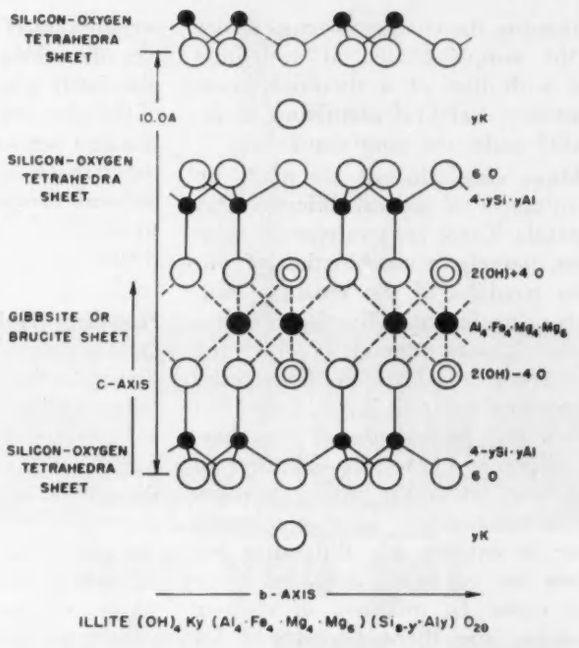

FIGURE 3—Schematic crystal structuer of illite.
(After Grim, Bray, Bradley,[4] Hughes.[2] Courtesy American Petroleum Institute.)

produce color changes in the clay. Such changes vary, depending upon the identity of the clay mineral and its composition. The color changes, therefore, provide a possible basis for identifying the clay-mineral components of clay materials. Certain aniline dyes, solutions of which vary in color according to their hydrogen-ion content, are satisfactory for clay-mineral identification as described by Mielenz and King.[5] Other substances, which probably change the color of the clay minerals, include aromatic amines, amino phenols, and benzidine as described by Dodd.[6]

Precise use of the petrographic microscope is necessary in obtaining optical data on clay minerals. The optical methods are suitable for determining properties of some of the clay minerals but are valueless for others, particularly when nonclay minerals, such as quartz, calcite, and feldspar, are present in the clay minerals in particles of similar size. It is usually possible to determine, with fair accuracy, the indices of refraction and birefringence of clay-mineral samples with the petrographic microscope. The optical properties of the various clay minerals are diverse enough so that it is possible to identify the clay minerals.

The cation exchange capacity of the clay minerals provides another method of identifying the type of clay mineral present in a given sample. One of the properties of clays is known as base or ion-exchange which is an ion-for-ion exchange between the clay-building unit and a water solution carrying the cation of greater attraction. The relative ability of clays to carry exchangeable cations is expressed as its base-exchange capacity and is measured in terms of milliequivalents per 100 grams of clay.

According to Grim,[7] there are three causes of the cation-exchange capacity of the clay minerals, namely, broken bonds, substitutions within the lattice structure, and the hydrogen of exposed hydroxyls being replaced by a cation that would be exchangeable. Broken bonds around the edges of the silica-alumina units give rise to unsatisfied charges, which are balanced by adsorbed cations. The number of broken bonds and, hence, the exchange capacity due to this cause increases as the particle size decreases and as the degree of crystallinity decreases. Substitutions within the lattice structure result in unbalanced charges in the structural units of some clay minerals. Sometime such substitutions are balanced by other lattice changes, but frequently they are balanced by adsorbed cations. The rate of cation exchange varies with the clay mineral, the concentration of the cations, and the nature and concentration of the anions. In general, the reaction for the kaolin type is most rapid, being almost instantaneous. It is slower for the montmorillonite type and requires a much longer time to reach completion of cation exchange for the illite type.

Differential thermal analysis, with suitable apparatus, determines the temperature at which thermal reactions take place in a material when it is heated continuously to an elevated temperature and, also, the intensity and general character of such reactions. Many substances undergo thermal reactions when they are heated. For clay minerals, differential thermal analyses show characteristic endothermic reactions due to dehydration and to loss of crystal structure, i.e., destruction of lattice structure, and exothermic reactions due to the formation of new crystalline phases at elevated temperatures. The identification of a particular material may be obtained from the characteristics of the material. In the case of the clay minerals, these characteristics include the reaction temperature and reaction intensity.

The results of thermal analyses generally are recorded in the form of a continuous curve on which endothermic reactions are conventionally deflected downward and exothermic reactions upward from a horizontal baseline.

The thermal curve is procured by

comparing the change in temperature of the sample heated at a definite rate with that of a thermally inert substance, calined aluminum oxide, heated under the same conditions.

Many clay minerals are made up of mixtures of several different clay minerals. There are two types of mixtures, namely, a combination of discrete particles of the separate minerals or an interstratification of layers of the separate minerals in which the thickness of the layers is of the order of one or a few unit layers. Grim[8] has shown the dependence of the characteristics of curves for mixtures of some minerals on the mixing intimacy of the components. In clay minerals there is considerable difference between the curves for mixtures of the two types. In mixtures of discrete particles, the thermal reactions for the individual components usually decrease in intensity and sharpness as the mixing intimacy increases. With regard to interlayer mixtures, the published curves reveal that sometimes the individual components are shown and at other times they are not.

The X-ray diffraction method is probably the most widely used, among the various methods of studying clay minerals for identification purposes and is of major importance in determining the crystalline structure of these minerals.

Two general types of apparatus are usually employed to record the X-ray diffraction pattern. Essentially, both are the same in the generation of X-rays but differ in the method of recording the X-ray diffraction pattern. One type uses the conventional diffraction camera with photographic film and the other a Geiger-Mueller counter tube with a scaling circuit that may be utilized to measure the intensity of the diffracted rays. The intensity is recorded either by the counting technique or by an automatic recording apparatus. Powder samples are usually employed because clay minerals exist as fine-grained materials. X-ray diffraction patterns are directly related to crystal structure and offer an excellent method of identification from consideration of basal spacings and basal intensities.

The electron microscope utilizes the concept of the scattering of electrons as the electron beam passes through the sample. The image formation recorded on the film is due to the electron scattering effect. Precise determination of the shape of the particles of various clay-mineral types has also been accomplished through use of the electron microscope. The latter has also been employed to investigate the particle size range of the clay-mineral components and the degree to which the particle size can be reduced.

Flooding Fluids. Fluid-flow investigations comprising liquid-permeability determinations are made on specimens taken from the same petroleum-reservoir rock samples used in analyzing the clay minerals. These determinations are made to evaluate the effect of clay-mineral content on the reduction of permeability to flow of various liquids. The liquids employed are kerosine, various types and concentrations of brines, and distilled water.

The pH of the flooding medium has a pronounced effect on the swelling characteristics of the clay minerals.[9] In a water-flooding system, the higher the pH of the water the greater will be the degree of swelling. The main colloidal constituent of the clay minerals is a hydrated aluminosilicate complex. The swelling power of the aluminosilicate varies as the ratio of alumina to silica varies in the complex, swelling being more pronounced in the complexes of greater silica content. A comparison of the crystal structures of kaolinite (Figure 1) and montmorillonite (Figure 2) shows montmorillonite has greater silica content than kaolinite. It has been mentioned in the first part of this paper that bonding, or lack of it, between clay crystals influences the swelling possibilities of the various types of clay minerals. An effect somewhat similar to low-pH waters will be obtained when brines are used as the flooding medium; that is, they will tend to cause shrinking and flocculation of the clay minerals, thus opening the pore structures of the sandstones to permit greater intake rates of the flooding medium.

Hughes[10] states that clays associated with oil-bearing sandstones should be kept in a permanently flocculated condition. The clay minerals are flocculated by acid, calcium salts in low concentrations, or sodium salts in high concentrations. However, sodium compounds in low concentrations or high pH values cause deflocculation of the clay. Although the percentage of clay minerals contained in the percentage composition of oil-bearing sandstones is relatively small, the clay percentage lining the pore walls of the producing sands is relatively high, and the smaller diameter pores have the higher percentages of clay linings.[11] Since the flood water and oil must come in contact with these surfaces, the choice and treatment of flood waters may be guided by considerations to avoid plugged formations and to obtain favorable results from the use of flood waters.

The flood water should be maintained at as low a pH value as is compatible with avoidance of excessive corrosion to avoid deflocculation of the clay minerals and to maintain intake rates at an optimum.

The permeability to water of clay-containing sand may differ from that to air due to the interaction of the water and clay content. Generally, this effect is more pronounced with fresh than salt water. The qualitative reversibility of the permeabilities characterizes these determinations, especially after extraction.

Flooding with brines[12,13] or connate water combined with low pH waters has been advocated[14,15,16] as being superior for water flooding. When brines are used for flooding purposes, it is probable that the ratios of the concentrations of the common cations, i.e., hydrogen, calcium, and sodium, may be important considerations in controlling the swelling of the clays present in oil sandstones. The absolute concentration of ions in solution is also important since the solutions must have a certain minimum concentration if certain replacements are to occur. Theoretically, it is probable that connate salt water or brine may have a stronger wetting power on the clay minerals in oil sands than fresh water. The use of brines would generally prevent swelling of the clay minerals and also, under certain conditions, would cause the flocculated clay minerals to become more granular and more permeable. According to Kelley,[17] calcium clays tend to be more granular and more permeable than sodium clays.

Chemical additives may be applied to the flood water to flocculate the clay minerals contained in the oil sands if a knowledge of the clay-mineral type is available. The addition of a solution of calcium chloride to a suspension of sodium clay partly

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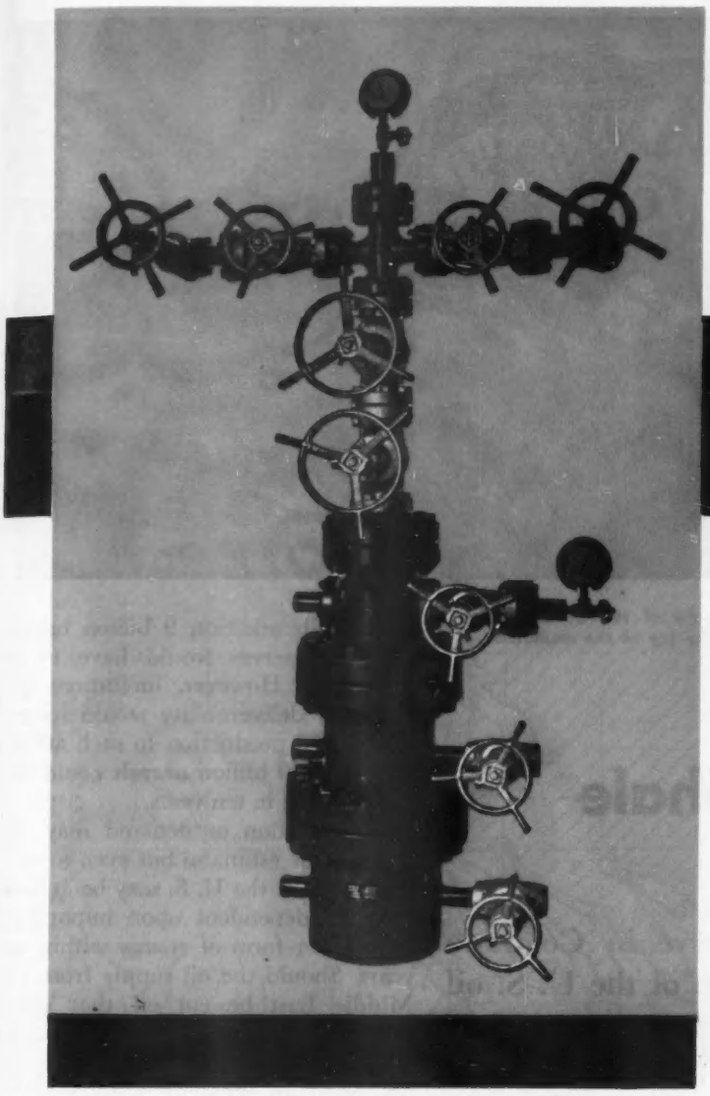

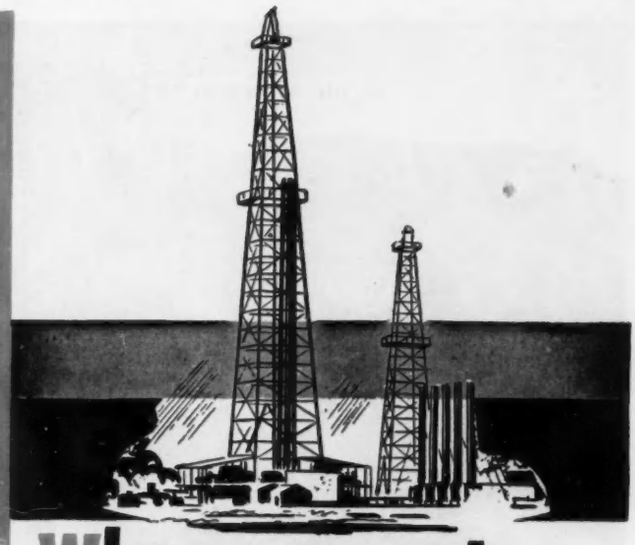

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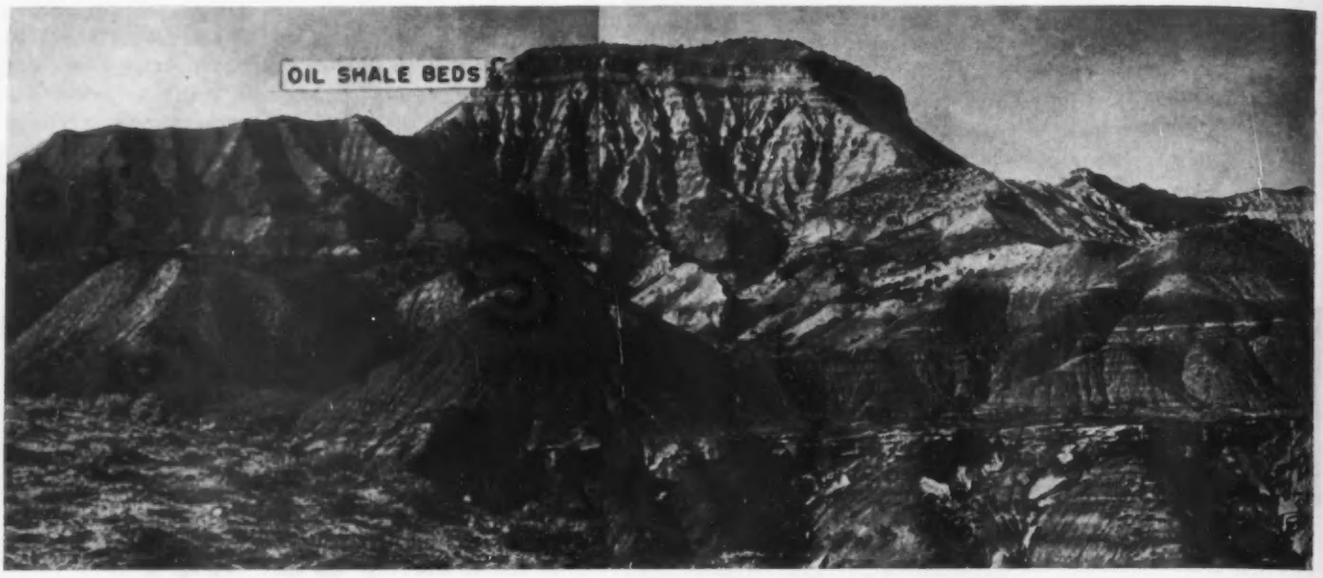

FIGURE 1—Mt. Logan, near DeBeque, Colorado. Typical topography of the Uinta Basin in Garfield County. Note the location of the oil shale beds near the top of the mountain.

Don't Overlook Oil Shale

The 100 billion-barrel reserve in Colorado may help to offset any possible depletion of the U. S. oil reserves. The detailed report of this reserve warrants close study in an era so dependent on oil.

By EARL TRAGER
H. Zindler and Associates, Inc.,
Dallas

THE EXPERIENCE of two World Wars has demonstrated that the oil resources of the U. S. may not be adequate to meet the demand made upon them in another national emergency. The 100 billion-barrel shale oil reserve in Colorado could make up the deficiency in time of emergency.

The American Petroleum Institute has estimated that the proven reserves of crude oil in the U. S. as of December 31, 1955, were 30,012 million barrels.

The daily crude oil production of the U. S. for 1956 is forecast at 7,210,000 barrels.

Various economists have estimated an increase of 50 percent in the U. S. demand within the next 10 years which would be approximately 13 million barrels per day in 1965. This 50 percent increased demand is almost the same increase that took place between 1946 and 1955. The total daily demand for U. S. oils in 1946 was 5,358,000 barrels and in 1955 it was 8,781,000 barrels.

If the anticipated increase occurs, the average daily consumption for the 10 years from 1956 to 1965 will be 10,700,000 barrels, which continued for ten years, totals 39,055 million barrels. To produce 39 billion barrels of oil in the next ten years from the oil fields of the U. S. would exhaust the entire 30 billion barrels reserve. In addition 9 billion barrels of new reserves would have to be discovered. However, limitations imposed by deliverability would reduce the rate of production to such an extent that 39 billion barrels could not be produced in ten years.

Consumption or demand may fall short of the estimates but even so they indicate that the U. S. may be at least partially dependent upon imports or some other form of energy within ten years. Should the oil supply from the Middle East be cut off that event would hasten the day when the U. S. will need a supplemental supply of oil. Such an incident might lead to the establishment of a shale oil industry in this country.

Present data indicates that there is a 100 billion-barrel reserve of recoverable shale oil in Colorado.

Part 1

History of Oil Shale Industry. France began the distillation of oil from shale in 1830 and has kept it up almost continuously since. Scotland established the industry in 1850 and was treating 3,500,000 long tons annually in 1935. Later she reduced the quantity to about half the amount.

Prior to the discovery of oil in Pennsylvania and for a few years thereafter a large part of the coal oil used in the U. S. was distilled from shales. There were between 50 and 60 plants operating in the states of Maine, Massachusetts, New York, West Virginia, Ohio, Indiana, Missouri, Michigan and probably others. The Scottish retort was used and the inventor was paid a royalty.

In 1859 the Lucesco Company was operating a shale-oil plant near Pitts-

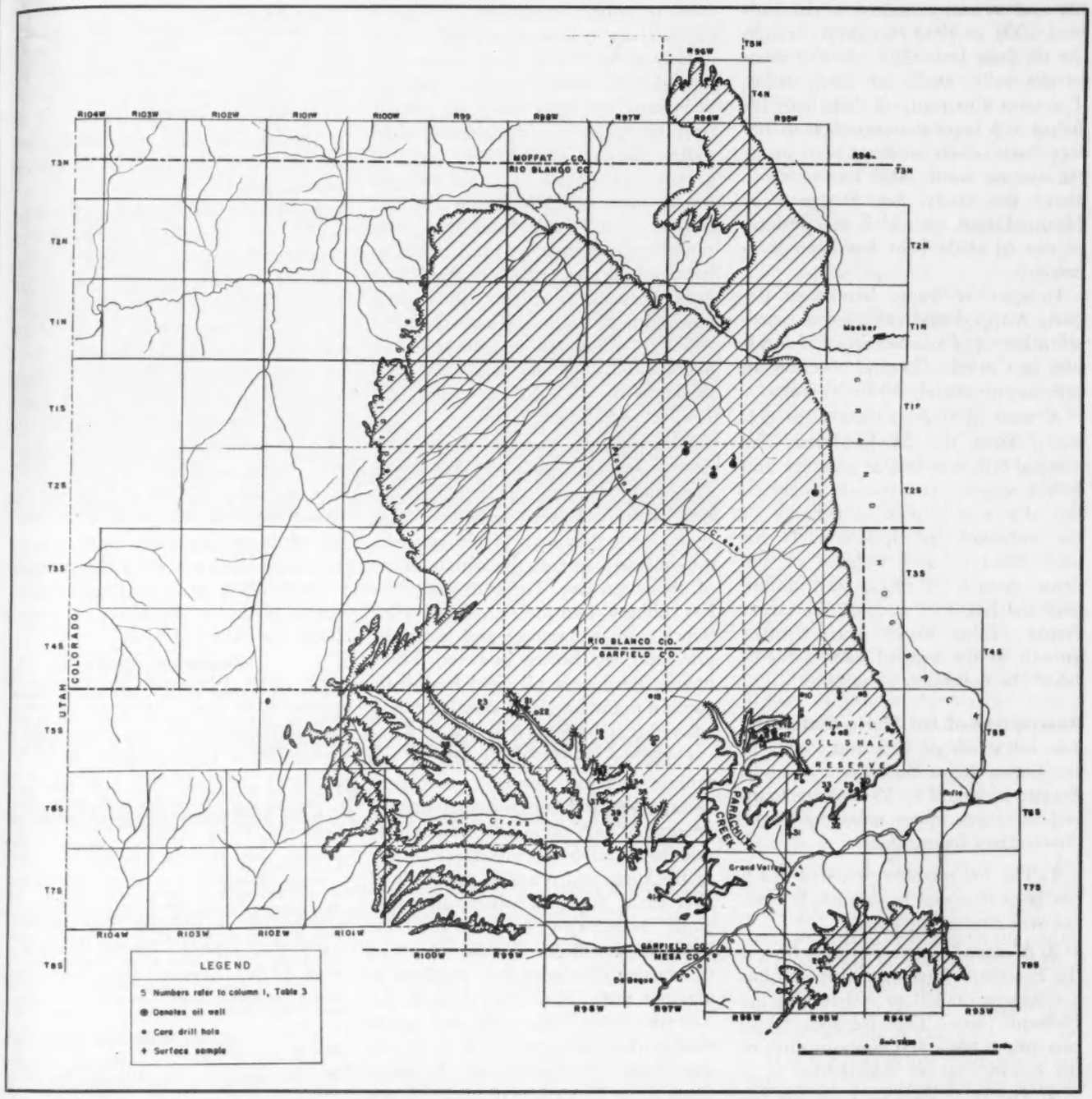

FIGURE 2—Areal distribution of oil shales in the Green River formation of Colorado.

burgh, Penn.,[1] which had a distillation capacity of 6000 gallons per day. By 1860 the company was operating 10 revolving retorts and 16 2000-gallon stills for fractionation. In 1864, just as the industry was becoming established in the U. S., oil was discovered in Pennsylvania which stopped the commercial production of oil from shale in the U. S. from that date to the present time.

When kerosine derived from Pennsylvania crude oil was placed on the market, the shale oil plants were either abandoned or converted into refineries for petroleum.

E. G. Woodruff, David T. Day and Dean E. Winchester called attention to the oil shale deposits of Colorado and Utah in early reports of the U. S. Geological Survey. Figure 2 is a map which outlines the area in Colorado that is underlain with oil shale deposits. This map is based on the work of Dean E. Winchester.

Petroleum shortages during World War I prompted the Empire Gas and Fuel Company, now the Cities Service Oil Company, in 1918 to make a preliminary survey of the feasibility of developing an oil supply from the oil shale deposits of the Green River Basin of Colorado, Utah and Wyoming. This survey indicated that the most favorable location for the early development of a major supply of oil from oil shale was in the state of Colorado.

Accordingly, in 1919 an intensive study was conducted by a group of geologists who mapped the exposures and sampled the oil shale sections. A field laboratory made many distillations and guided the geologists in their mapping and sampling to the sections which yielded the greater quantity of oil on distillation.

In Garfield County, Colorado, up-

lift and stream erosion has cut canyons 2000 to 3000 feet deep through the oil shale beds thus exposing them in the valley walls for many miles. The most important oil shale beds are found in a vertical section 300 to 700 feet thick which outcrops high up in the canyon walls, 2000 feet or more above the valley. See Figure 1 of Mount Logan on which the position of the oil shale beds has been indicated.

In spite of many handicaps the party mapped and collected a representative set of samples from 55 localities in Garfield County, covering an area approximately 18 by 24 miles.

A total of 942 samples were collected from the 55 localities. The original objective was to measure and collect samples at two-mile intervals, but this was impossible because of the unbroken, precipitous cliffs for long distances and because of the dense growth of brush and timber near the heads of some of the larger creeks. Talus slopes and timber growth in the upland valleys facilitated the collection of samples.

Description of Oil Shale Outcrops. The oil shales of this area occur in the Green River formation which is Eocene in age. The 1919 party mapped the three upper members of the Green River formations.

1. The top member, much of which has been removed by erosion, is present over most of the area.

2. A second member, just below, is the Parachute Creek member and has a thickness of 400 to 700 feet in the DeBeque area. This member forms precipitous cliffs and contains most of the commercial oil shale beds.

3. The third member from the top forms less precipitous cliffs, is frequently partially covered by a talus composed of chunks of oil shale and is noted to contain no oil shale layers of commercial importance except near the head of Parachute Creek.

Subdivision of Middle Member. Most of the samples collected were obtained from the second or middle member, which was subdivided into three cliffs.

The shale of the uppermost cliff No. 1 does not form a precipitous cliff over the entire area. It more frequently slopes steeply back from the top of cliff No. 2 and may be all or partially covered by sage brush, pine trees or other vegetation. This cliff contains up to three shale beds which appear to be massive and are six feet to eight feet thick, but these massive beds weather to a curly or crinkly form along the outcrop and are called paper shales. These beds yield a greater quantity of shale oil per ton on distillation than the average. On a freshly cut face the curly shale appears massive and contains bands of various brown shades. These beds are also noted for their variability in thickness and lateral extent which is a marked exception to the average oil shale deposit. The total thickness of Cliff No. 1 varies from 150 feet to 250 feet.

Cliff No. 2, the middle bed, is practically vertical over the entire area and averages 180 feet in thickness. It is composed mostly of lean shales with thin beds of richer shales one-half to two feet thick at intervals of about ten feet. The lean shales are less rubbery than the rich shales when struck with a hammer and are more gray and less brown in color. Those having the lowest oil yield frequently contain many bands of very light gray colored marlstone.

Cliff No. 3, the basal bed of the middle member, forms a prominent escarpment and contains the greatest percent of rich oil shale of the entire middle member. It averages 54 feet in thickness and contains five beds of rich shale, three of which are especially noteworthy because of their thickness and high oil yield. One bed of massive oil shale that weathers to a paper shale, is six feet thick at the western side of the area and up to nine and two-thirds feet thick in the Parachute area to the east. It assays from 33 to 85 gallons of shale oil per ton for the entire thickness. This third cliff averages to have ten alternate beds of rich and lean shale with a thin ironstone lens below the third bed from the top, which is an excellent marker for correlation purposes. The uppermost bed of this series is sometimes referred to as mahogany shale because of its beautiful brown color.

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Part 2 of this article will appear in a coming issue of WORLD OIL.

Clay Minerals

Continued from Page 192

flocculates the clay.[18] If sufficient salt of aluminum or thorium is added to the clay, the electric potential or charge on the clay colloid is reduced to zero, and the clay is completely flocculated.

Bentonitic clays placed in contact with a positive colloid should become flocculated because of the neutralization of the negative charge on the bentonite by the deflocculating agent of the positive colloid. The surface bentonite should also be neutralized by the positively charged colloidal particles themselves. The foregoing process of removing the replaceable base in bentonitic clays, i.e., the sodium base, with another base that is less hydrated is called "dialysis." A measurable osmotic pressure is exerted by ordinary bentonite, but dialyzed bentonite does not exert this pressure. This indicates that swelling is an osmotic phenomenon, since dialyzed bentonite does not swell.

ACKNOWLEDGMENTS

The author acknowledges the permission of William H. Strang, director, and Roy F. Carlson, assistant to the director, Division of Production, American Petroleum Institute, Dallas, to use illustrations showing the schematic crystal structure of clay-mineral types.

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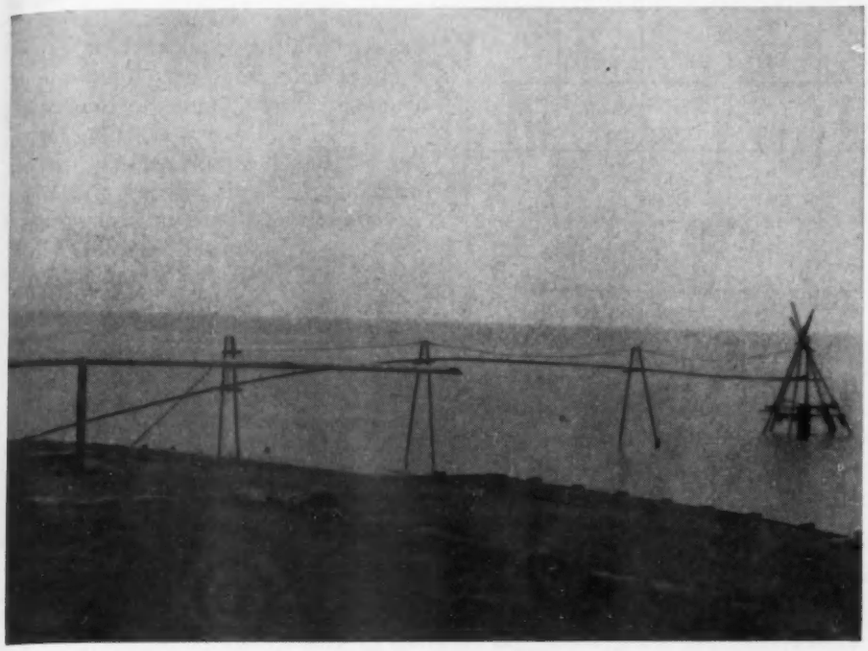


FIGURE 1—The casing protruding above the water in this well marks the location of Japan's first oil discovery. Although credited with being capable of producing small quantities of crude, the well is not being produced.

A current report . . .

Japan Stepping Up Drilling Program and Conservation

Author, who returned recently from Far East visit, reports Japanese touring world's centers of technical know-how in effort to keep abreast of latest techniques and practices.

By A. B. WATERS
Halliburton Oil Well Cementing Company
Duncan, Okla.

OIL SLICKS ON the Japan sea were the first indication of oil in Japan. This was near the town of Izumozaki in Niigata Prefecture. About 1888, small islands were built out into the sea on which caisson type wells were then dug by hand to the oilbearing strata. Thus, Japan claims to be the first country to do offshore drilling for oil. Oil from these wells was brought to the surface by buckets.

A memorial museum and park recently have been established at the location of this first oil discovery in Japan. A casing still is protruding above the water on Well 3, Figure 1. Currently, it is not producing any oil; however, it was reported to be capable of producing very small quantities.

From this, Japan reached its maximum oil production in about 1916 when 2,961,000 barrels of oil were produced, Figure 2. Since most of the fields were rather small in area, with small reserves, it was necessary to discover many new fields to maintain their production level. Most all of these fields have been in the northwestern part of the main island of Honshu along the Japan sea, Figure 3.

Yabase, the largest field, was discovered in 1933 with only two shallow oil bearing intervals. Since then, deeper zones have been discovered periodically until now this field accounts for about 60 percent of Japan's production.

In Japan, as in several places during the early development of oil in the U. S., many of the fields were drilled without regard to spacing or conservation. Much of this was due to the large number of producing companies competing for oil production. Since the war, considerable study and work have been done to conserve what oil has been discovered. One major waterflood has been very successfully established in the shallow (Figure 3) zone of the Yabase field. Other waterfloods have been started but have had varying degrees of success. Gas is being injected into several of the deeper zones of the Yabase field to maintain pressure. Very complete reservoir conditions are continually checked and evaluated.

Formations in most of the fields, especially deeper zones, are faulted, anticline type structures, with the majority having gravity and solution gas drives. Although the Yabase field is an anticline fault type reservoir producing approximately 34 gravity oil, there are many other types. Mogami field is a fissure type reservoir, producing 17 gravity crude; while Shonai field is a fault trap producing 17 to 19 gravity oil from a pure sand formation. A very viscous asphaltic oil is obtained in the Chokaizan field; in fact, so viscous it is almost impossible to produce. The Niigata gas field is very prolific but about a cubic foot of water is produced directly with each cubic foot of gas.

Higashiyama, or East Mountain field, is world famous for the mine or gallery that has been dug through part of the field. Oil seeps into the mine where it moves through open ditches to central pumps. When the mine was first opened it produced 150 barrels of oil a day, but is now down to 90 barrels a day. Some waterflooding has been successfully attempted here.

Most of the formations are Pliocene and Miocene age. These vary from well consolidated sand to poorly sorted, loosely cemented tuffacious sands. Formations currently producing the most oil in the Yabase field (Zones V through IX) contain silica, felspar, montmorillonite, analcite, zeolites, and calcite. Percentages of these vary with

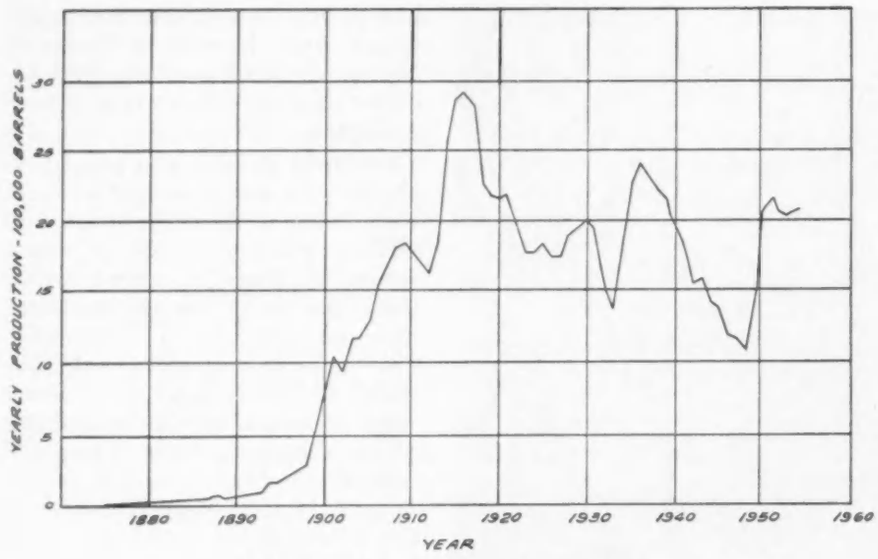


FIGURE 2—History of Japan oil production.

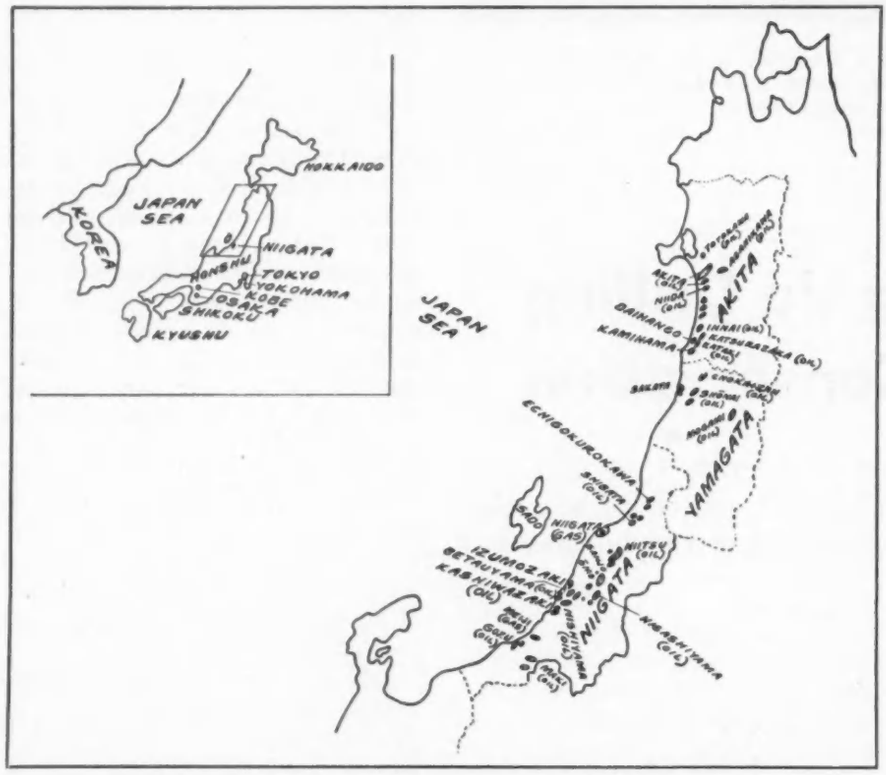


FIGURE 3—Major oil producing area. Inset shows location of enlarged area.

depth and location in the field.

A very extensive drilling program is being conducted in the Yabase field, where several extensions have been found in the deeper zones. Common practice in this field is to drill three or four wells very close together, each to different zones, by merely skidding the rig a few feet; thus decreasing the drilling time per well. This is possible in this field as it is located in a very flat section in the middle of one of the largest rice producing areas in Japan. Drilling in many other sections is more complicated due to the mountainous terrain and large boulders encountered while drilling. The standard derrick is used almost entirely.

Currently, the deepest production is coming from the XII zone at about 5500 to 6000 feet. One exploratory well has been drilled to approximately 10,300 feet but has been plugged back to IX_3 zone, which is now producing. The bottom 3000 feet are not shown in this figure.

Prior to World War II, there were two major and two minor producing companies as well as many very small ones. With the acquiring of additional oil resources and to facilitate the development in Japan, the government formed the Teikoku Oil Co., Ltd. in 1941. This company was the consolidation of all the major and minor companies and a majority of the small ones with the government furnishing half the capital.

In 1950 the government relinquished its control, allowing Teikoku to become a private company, but the government remained a major stockholder. In 1955, under a special law, the government formed an exploration company, Japan Petroleum Exploration Company, Ltd. Thus, the exploration department was separated from the producing company. However, Teikoku still is subsidized in some ventures, especially the exploration it does in its producing area. There is much talk of drilling offshore in the very near future near Sakata and Akita.

Although there have been very small amounts of oil produced on the

About the Author

A. B. WATERS is an engineer with Halliburton Oil Well Cementing Company, having joined the organization in 1946. He received his degree in 1941 and was employed by E. I. du Pont de Nemours Company, Inc., prior to serving in the armed forces during World War II.

Since 1949, when hydraulic fracturing became commercially available, he has introduced it in many sections of the U. S., Peru, Mexico, Venezuela and Denmark and now serves as assistant to the technical supervisor of this service. Recently, at the invitation of Teikoku Oil Company, Ltd., he visited Japan to study the possibilities of applying production stimulation techniques.

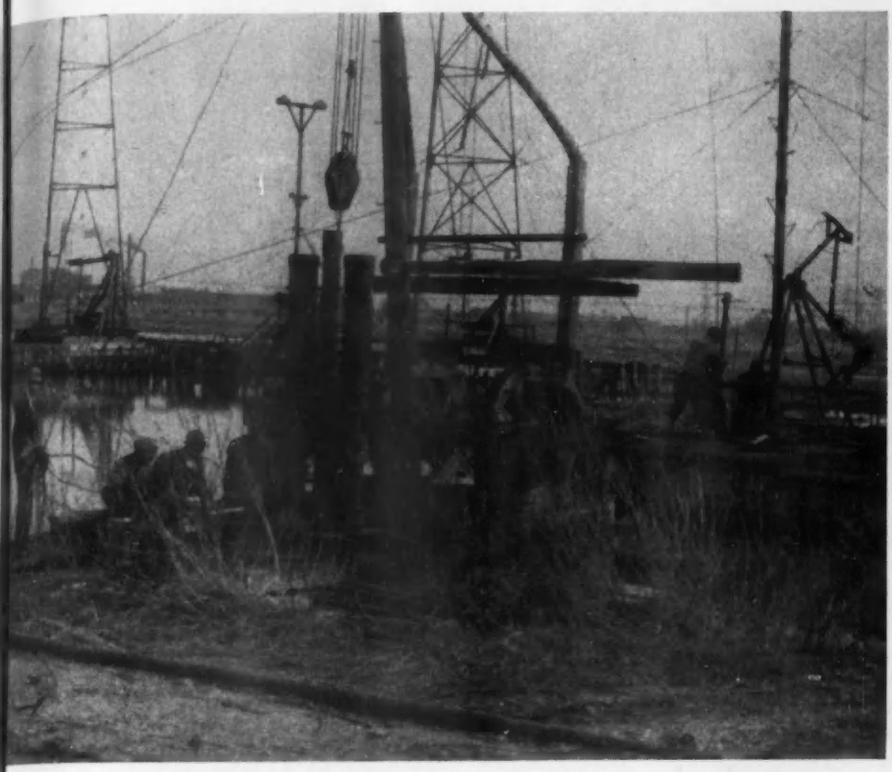


FIGURE 4—Casing is being pulled on this old well in Yabase field. This portion of the field is located in a shallow lake. The drilling rig seen in the background is shrouded to prevent oil from blowing on the rice field.

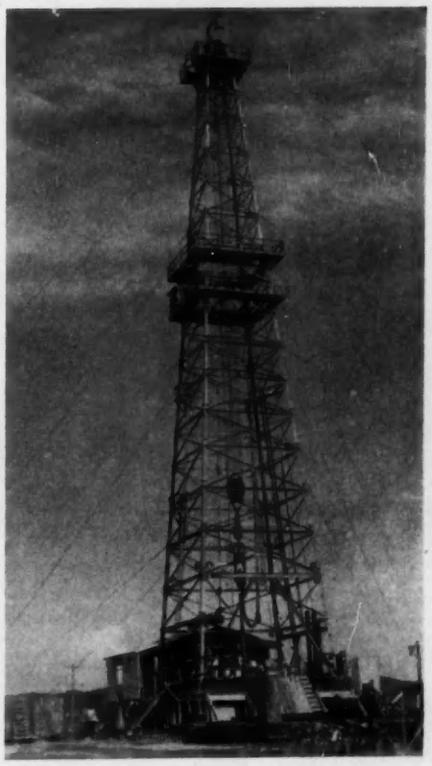


FIGURE 5—Here, one of the standard derricks used in Yabase field has just been skidded a few feet so a third well can be drilled at this site.

island of Hokkaido, Japan Petroleum Exploration Co., Ltd., only recently discovered some very good oil shows. It is also doing seismic and exploration drilling in many different areas, (deleted). A new rig was recently imported to do much of this exploration drilling. U. S. and German seismic companies are now working to expedite the surveying of northern Japan.

Teikoku accounts for approximately 97 percent of the oil produced in Japan; but domestic production, approximately 5500 barrels a day, accounts for only 3 to 6 percent of the country's requirements. A considerable amount of the remaining quantity is imported from the Middle East in exchange for tubular goods and other commodities. Other oil demands are fulfilled by imports from the U. S. and Indonesia.

FIGURE 6—Typical is this Yabase field scene with drilling rigs in the background and farmer plowing a rice paddy in the foreground.

Gas is supplied to municipalities or industry with a considerable amount of it being bottled. Gas is not used for heating many homes, however. A partnership recently has been formed between Teikoku Oil Co., Ltd., and a chemical company to build a petrochemical plant to utilize some of the gas produced in the Yabase field.

Several of Japan's petroleum managers, advisers, and engineers have made trips to the U. S. and other countries to study new techniques of exploration, logging, drilling, completions, secondary recovery, and production improvement techniques, endeavoring to keep abreast of current procedures. Through these studies and the extensive exploration program that is being conducted, Japan hopes to produce a larger percentage of its critical oil requirements.

ACKNOWLEDGMENT

The author wishes to thank Teikoku Oil Company, Ltd., and Halliburton Oil Well Cementing Company for permission to publish this article. He is also indebted to the engineers of Teikoku Oil Company, Ltd., for data furnished by them.

Quickly-dug channels route crude away from the wellhead of the new Iranian discovery well before it was brought under control by Myron Kinley, internationally-known oil well firefighter from Houston, Texas.

What's the Significance of Iranian Discovery?

Here is what an official of National Iranian Oil Company told WORLD OIL in an exclusive interview . . .

A. H. Farjam, general superintendent, Products Pipe Line department, National Iranian Oil Company, arrived in the U. S. in October for a six-months tour. During his visit, he attended the School of Pipe Line Technology at Baytown, Texas, sponsored by the American Petroleum Institute and conducted by The University of Texas Extension Service.

By DON KLIEWER
WORLD OIL *Staff*

Q *Since the Qum discovery well blew in out of control on August 26, its potential producing rate has been discussed widely. Will you estimate as near as you can what your company believes the well is capable of producing?*

A Before the gusher was capped, the whole of the area in the immediate vicinity of the well vibrated from the force of eruption, and it was feared that this may have damaged the concrete around the casing. It was not, therefore, considered safe to shut the well off completely. However, attempts at shutting the valve completely even for a split second produced a pressure of 5000 psi at the wellhead. A two-inch and a one-inch branch on the side of the casing were allowed to bleed a quantity of oil estimated to be 60,000 barrels daily. Subsequently, of course, service company operations were begun and the

well was brought under complete control and prepared for production.

Q *When was the well brought under control?*

A Mr. Kinley (Myron Kinley, internationally known well firefighter of Houston, Texas) was called to direct the operations for controlling the well when initial efforts failed, and after much preparation and work under extremely hazardous conditions, he was able to cap the well on the morning of Sept. 12.

Q *What was done with the crude produced from the time of the blowout to September 12?*

A Special channels and bunds (dikes) were constructed to catch the oil and to prevent its flowing onto the nearby town of Qum and the Trans-Iranian railway.

Q *How much oil do you estimate was caught in this manner?*

A Over 1½ million barrels of crude of a high flash point now is lying in bunded areas, but most of the volatile contents have escaped after exposure to the hot desert sun.

Q *What does the Iranian government plan to do with this newly-discovered oil?*

A Considerable discussion has been held on that subject, of course. With domestic consumption at the 14 million-barrel annual level (38,350 barrels daily), it has been suggested that a refinery could be constructed in the area and thereby reduce freight charges now being paid on the oil used in that area.

Also, the possibility of constructing a pipe line to the Mediterranean sea through Turkey has been suggested and possibly supply oil-short Turkey with crude instead of paying royalties on the right-of-way.

Q *At what price would the oil be sold?*

A At the Persian Gulf posted price (slightly under $2 per barrel as compared to the U. S. Gulf Coast price of about $3.25).

Q *Is the crude of a paraffin base?*

A Yes, and of high residual content.

Q *Of course, the new producing area has not been explored, but will you give some estimate of the proved crude reserves established by the Qum discovery?*

A A conservative estimate of a reserve of 400 million barrels has been made. Development drilling being planned will shed further information in time.

Q *Mr. Farjam, in conclusion, will you explain how the Iranian government agency operations led to this significant discovery?*

A In October, 1949, while the British-owned Anglo-Iranian Oil Company (now The British Petroleum Company) was still operating in Iran, the Oil Exploration Company was formed by the Iranian government to explore areas which had favorable formations and which lay outside the concession area of the AIOC.

This company conducted preliminary geological surveys in likely places on the central plateau as well as in the southeast and in the north of Iran. As a result of these surveys, Qum area—85 miles south of Teheran—was selected as the first site for drilling operations. This place had the asmara formation very common in the oilfields in south and southwest Iran. After some preliminary preparation, drilling was commenced on the first well, but soon had to be abandoned due to technical difficulties at 4592 feet.

Two years elapsed before the Oil Exploration Company decided to continue drilling in order to formulate the extent of the broken subterranean formation. After obtaining the necessary data, well 2 also was abandoned at 2197 feet.

From data thus obtained, a site was selected for Well 3. Drilling began in the winter of 1951. On June 2, 1952, this well struck an oil seepage at 7504 feet and, in 48 hours, 300 barrels of a highly viscous and extremely low sulfur content oil, along with a large amount of gas, flowed from this well at a high pressure. But the flow ceased abruptly. At this stage, further investigations had to be postponed, pending the acquirement of special equipment available from south Iran.

Due to various reasons, including financial, this interruption of drilling activities lasted about eight months. But in the interim the geological survey of the area was continued and some valuable information collected.

In February, 1953, drilling was resumed at Well 3, but the drill bit was sheared at 7554 feet due to a cave-in. The well was abandoned.

Drilling operations then were transferred to 2½ miles to the southeast of Well 3; however, this hole also was abandoned for technical reasons.

Meanwhile, administration of this Exploration Company was passed on to the National Iranian Oil Company which has more resources at its disposal. The latter company began drilling Well 5 near Qum at a preselected site in January, 1955. The technical know-how of this company and its drilling contractors surmounted difficulties encountered which were common to the previous wells in this area and, in the early hours of August 26, when liquid mud was being pumped into the well, suddenly the column of mud began to be thrown up and a gusher started rising to over 250 feet high.

—The End

This tanker is passing a channel dredge on its way through the inner part of the new channel at the entrance of Maracaibo Basin. The channel makes it possible for ocean-going tankers to enter Lake Maracaibo.

New Deep-Water Channel In Venezuela to Be Dedicated

La Salina and Maracaibo are directly connected with the world's deep-water facilities as 35-foot deep channel into Lake Maracaibo is completed.

OF TWO CURRENT projects expected to accelerate development of Western Venezuela, one was scheduled for formal dedication this month and the second was reported 25 percent complete.

Completed is the government's ship channel linking the oil fields of Lake Maracaibo with the world's deep-water ports.

Twenty-five percent complete and already in limited service is Creole Petroleum Corporation's 120-acre concrete island terminal located just off Lake Maracaibo shore from the company's La Salina facilities.

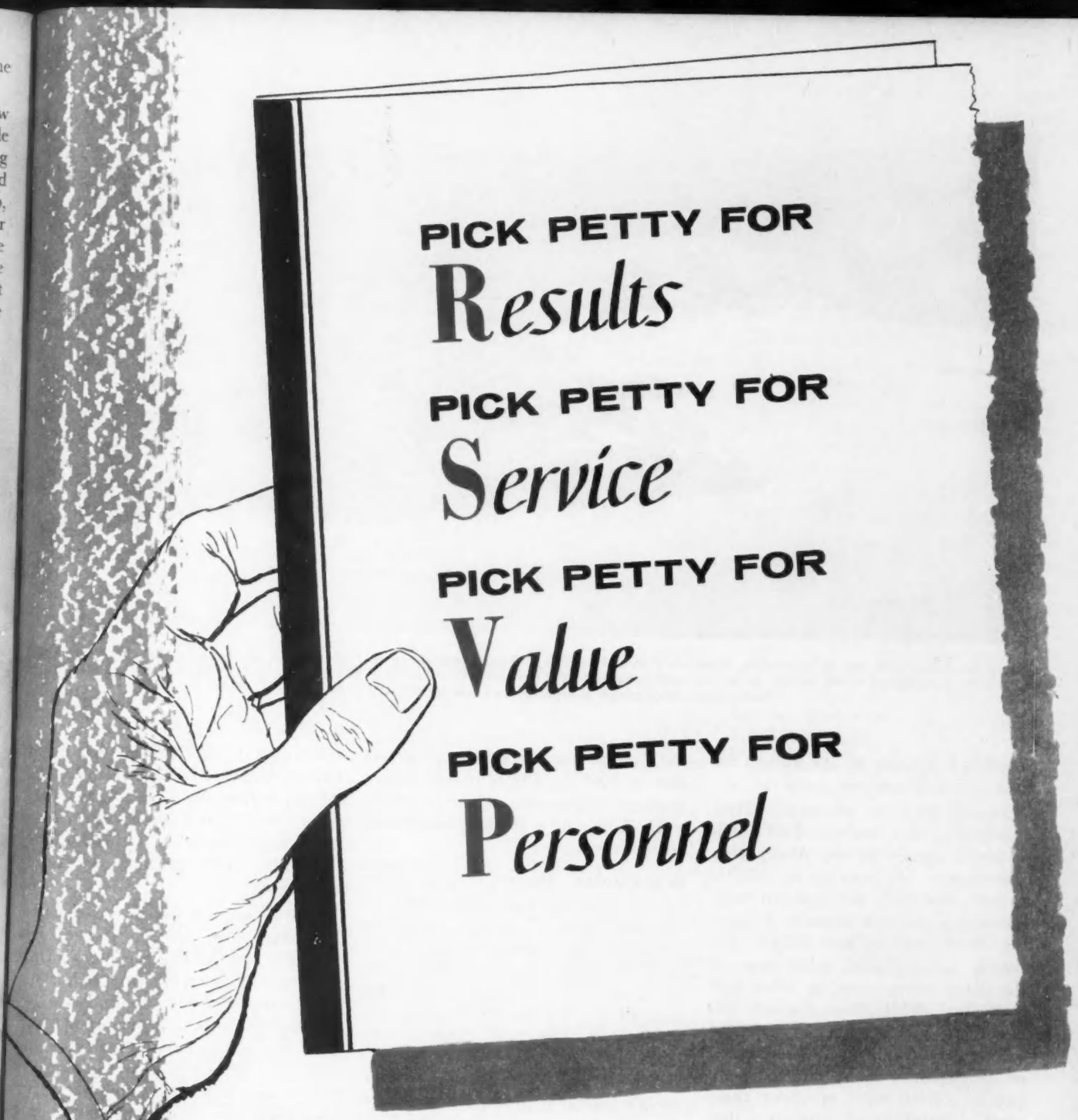
The Venezuelan government's new channel, 35 feet deep, will enable ocean-going ships to leave docking facilities at La Salina, Maracaibo, and other loading points with a full cargo, and to sail direct to other deepwater ports without reloading. And at the Pan American Highway Conference in February, Venezuela advised that it would build a 4 1/3-mile bridge across the Maracaibo strait.

Creole Petroleum's new island terminal will include several million-barrel storage tanks and docks for several supertankers, each with facilities to load at the rate of about 40,000 barrels an hour. Unique features, including a steel fender that will encircle the island to prevent tanker hulls from being smashed in choppy water, will be incorporated. The fender—on steel and rubber springs—will be suspended four feet away from the edge of the concrete.

Pipe Line Facilities. Previously, moving of Lake Maracaibo crude has been mainly by pipe line. In 1949 Creole completed a 24-26-inch pipe line from Ule, in Tia Juana field, to the Amuay refinery, on the Paraguana peninsula, 120 miles northeast. Initial daily capacity was 300,000 barrels, which has been greatly increased since completion of the line. In 1950, Compañia Shell de Venezuela completed a 30-inch pipe line with an initial daily capacity of 235,000 barrels, from Palmarejo, on the western shore of the lake, to the Cardon refinery.

Additions to pipe line capacity have been made by both companies through both new line construction and installation of more pumping equipment on the same lines, but still it has been necessary for both companies to maintain a fleet of shallow draft (13 feet) tankers to transport oil produced in excess of pipe line capacity to the refineries and to deep water facilities.

Creole's fleet of small tankers has varied considerably but has averaged about 35 in number during the past few years. Both companies will maintain their shallow draft fleets until the transition to supertanker movement of the excess crude is assured by completion and satisfactory maintenance of the new channel. Confidence that the channel can be kept at sufficient depth for supertankers is reflected by



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SEISMIC GRAVITY MAGNETIC SURVEYS

This is the harbor and city of Maracaibo, Venezuela's second largest city whose population in 1955 was put at about 350,000. Now that Lake Maracaibo is connected to the world's deep-water ports, thanks to the government's dredging a 35-foot deep channel into the Gulf of Venezuela, accelerated development is expected to occur in Western Venezuela.

Creole's budgeting of $17 million for its new island terminal.

Operations of the new canal will be handled by the Instituto de Canalizaciones, agency of the Venezuelan government. Volumes up to 700,000 barrels of oil daily are expected to be moved via the new channel. Financing of the $45 million project was readily accomplished, with most of the bonds being promptly subscribed by Creole, Shell, Mene Grande Oil Company, The Texas Company, and Richmond Oil Company. Redemption of the bonds is to be effected from proceeds from tolls, at about three cents a barrel on oil, and on a tonnage basis on other cargo.

Dredging of the channel through El Tablazo Bay began in April, 1953, by Compania Fomentadora de Venezuela Occidental, S. A., a syndicate comprising four U. S. companies specializing in dredging operations. This portion of the channel is 14 miles long, crossing the bay from Punta Palmas at the mouth of Maracaibo strait to the west end of Zapara Island. The depth is 35 feet and the width is 600 feet. This part has been open to traffic since December, 1954.

The Outer Canal, extending north seven miles from Zapara Island into the Gulf of Venezuela, was completed late in 1955 by Construction Aggregates of Venezuela, after a year's work. This part is 1000 feet wide and 36 feet deep.

Breakwater. Parallel to the outer canal, extending two miles north of the west end of Zapara Island, a breakwater was constructed of hard rock, to keep ocean currents from filling up the outer canal with sand and silt. In all, the project will cost $55 million. The entire channel is 46 miles long.

Oil, of course, is Western Venezuela's principal product and source of revenue, but the rise of the City of Maracaibo, which enjoyed a phenomenal growth in population from 232,488 in 1950 to 350,000 in 1955, to ocean port status should stimulate its economy and that of the State of Zulia even more rapidly. Oil not only will move out of Zulia more efficiently than before but also the imports that the formerly-isolated province needs for growth of agriculture and industry will be brought in more expediently.

A high-level bridge over the Maracaibo strait, perhaps from Maracaibo on the west side to Altagracia on the east, appeared feasible. Construction of it should be easier, for instance, than that of the Golden Gate and Chesapeake Bay bridges in the U. S. Ample engineering data are available from Creole's and Shell's experience of operating in Lake Maracaibo, and from the dredging and pipelaying operations.

The bridge was still in the speculative stage, but the government reportedly was asking for bids. Plans call for completion by December, 1957, at a total cost of $18 million. An archtype bridge with a suspension section over the ship channel would seem logical; a draw-bridge would not, as ship traffic is virtually continuous in the Maracaibo strait and should increase in coming years.

If the bridge is built, highway routes, which now lead all the way around the lake, would be shortened considerably. If a railroad or combination highway-railroad bridge were feasible, Maracaibo might, in time, be connected with Puerto Cabello and Caracas to the east by rail. Venezuela's existing railroad system is a mixture of short, multi-gage spur lines, many of which are obsolete and in ill repair, but the government is attempting to correct this situation with a long-term railroad building program. —**The End**

Hungary Producing Most Of Its Domestic Oil Needs

Here, from private WORLD OIL sources, is a summary of new discoveries in this Soviet satellite, in addition to a field-by-field report, written immediately prior to the October rebellion.

HUNGARY, SITUATED east of Austria and having a population of 10 million, was a monarchy without a king from 1918 to 1945, when on January 31, the republic was proclaimed. From then until Aug. 20, 1949, a multi-party government administered Hungary's 36,000 square miles.

The presence of Soviet army elements in Hungary brought about strong power for the small Communist party which was able to proclaim the new People's Constitution in August, 1949. Since then, Hungary's government has been following the Russian course with great enthusiasm. Ruthless exploitation of the country's natural riches has created a deep anti-Russian feeling on the part of the people, however.

Economically, Hungary is a solid part of the Council of Mutual Economic Assistance (pact of Jan. 25, 1949). Participating in the great "strive to achieve socialism," Hungary has wasted billions of dollars, employed forced labor and wrecked its agriculture.

Yet, Hungary has achieved some remarkable records: a big steel industry, a large aluminum industry, and an oil industry that can supply almost 100 percent of its domestic requirements.

Russia was able to grab a 50 percent share in Hungarian oil on Dec. 20, 1945, when Maszolaj Company was founded. It operated along lines paralleling the American-Hungarian Maort Company (Amerikai Olajipari Reszeny Tarsag) and became a monopoly after Maort was incorporated into Maszolaj. The incorporation proceedings were effected without reimbursement to the owner, Standard Oil Company (New Jersey). Reports in 1950 said the Hungarian government had transferred all of the Hungarian oil interests to the Soviets in a secret deal in return for the German Foreign Assets located in Hungary. But no proof was ever established.

As a matter of fact, Maszolaj was dissolved Nov. 8, 1954, when Russia sold its shares to Hungary for an unreported price.

Drilling. Three hundred wells were completed during the Five-Year Plan from 1950 to 1955. Most of these wells were drilled at Nagylengyel, and provided a 140 percent increase in crude production, comparing 1949 output with that of 1954.

Drilling activities were reported from the southern fields at Zalaergerszeg, where holes were drilled to 5940 feet.

Little or no favorable results were achieved by drilling at Bueszag during the second half of 1954 and at Komlo during the first half of 1955.

No drilling has been tried around Buzakeretye since efforts failed in 1952-1955. Natural gas has been found at Nadudvar, but the well caught fire during the first week in December, 1954, and reportedly was still burning.

Gas wells were drilled during late 1954 near Orszentmiklos and Csomad, about 18 miles from Budapest. The producing level ranged between 200 to 1225 feet, respectively.

"Faster drilling for more oil" is one of the slogans employed by the Hungarian oil managers to increase drilling speed (through increased pressure on the bit and higher rpms at the rotary table).

The use of portable drilling rigs is a new development in Hungary. Another change is the replacement of electric motors on pumps with natural gas engines.

Additional drilling is expected to extend the Gelenhaza producing area and to develop new producing sites.

Production. Production in 1955 was described as being 31.6 percent greater than that of the preceding year. Data available on 1954 output range from 8,530,340 barrels, as reported by the Hungarian Statistical Bureau, to 9,285,710 barrels, as reported by Tass, the Soviet news agency. Thus, 1955 production can be put at between 10,813,000 barrels and 12,143,000 barrels.

Still another source reported 1955 output at 43.9 percent greater than 1953 production, with 1953's level earlier placed at 6,332,900 barrels. So, the 1954 output is calculated at 8,530,340 barrels.

Production of Hungarian fields is reported each year at different levels, as in other Soviet satellite countries. The most creditable figures available are shown in Table 1.

Table 1
Crude Production in Hungary—1938-1955
(In Barrels)

YEAR	Group A (United Nations)	Group B (Hungary)
1938	328,090	328,090
1943	6,401,570	.....
1945	4,997,650	4,997,650
1946	5,226,550	5,226,550
1947	4,349,100	4,349,100
1948	3,692,920	3,692,920
1949	3,837,890	3,837,890
1950	3,815,000	3,815,000
1951	3,815,000	4,806,900
1952	3,815,000	5,722,500
1953	6,332,900	6,332,900
1954	8,530,340	9,262,820 (Tass)
1955/P	.....	11,826,500
1955	.....	12,208,000

P/ means Planned.

The Hahot oil field, a 1947 discovery, was a short-lived producer. It declined sharply during 1953 and, by now, is producing only gas. Five wells were drilled there in 1947, of which the three became gas producers. Depth ranges from 3609 feet to 4265 feet.

Budava field also was declining in production, as was the Lovasci field. The latter, developed by Amerikai

Olajipari Reszeveny Tarssag (Maort) from 1937 to 1939, was the backbone of the nation's prewar crude production.

Production plans in Hungary mentioned oil output only rarely during the past few years, and only then when production rose significantly.

The 1952 plan, for example, demanded a 66 percent increase in drilling, a boost of 14 percent in oil output, and a 13 percent rise in natural gasoline yield. It was during 1952 that water injection methods of secondary recovery first were used in Hungary.

The primary energy balance for 1949 and 1954, as well as the estimated balance for 1955, (Table 2) shows the increase in the oil and gas industry's participation.

Table 2
Primary Energy Balance in Hungary
(In Percent)

PRODUCT	1949	1954	1955 (Estimated)
Coal	84.4	80.2	77.0
Crude Oil	9.0	12.6	15.0
Natural Gas	2.4	2.9	3.0
Peat	0.4	0.8	1.0
Wood	3.7	3.4	3.0
Water	0.1	0.1	1.0
Total	100.0	100.0	100.0

Hungary's crude production currently stems from:

- Zala area. Includes Zalaergerszeg, Lovaszi, Mezoetur, Lispe, and Budafa oil fields, of which Lispe is declining while Mezoetur is called the area of "highest hope."

- Nagylengyel oil field, which is producing at a high rate. Together with Mezoetur, Nagylengyel leads the nation's fields in crude output. Within Nagylengyel field, crude output began at the Goecsej area late in 1951. And the area's yield reportedly doubled from 1954 to 1955. Descoe Baka, Goecsej area chief, said on June 29, 1955, that more oil was being delivered from there than from Lispe-Lovaszi areas. Producing depth is 6500 feet.

- Maszolajfalva, Totkomlos and Matra-Novak oil fields, which in 1955 produced approximately 15 percent of the 1955 total output for the nation. Despite efforts to expand these fields, actual crude production from them has decreased since 1954.

Pipe Lines. The crude pipe line from Zalaergerszeg to Soifok branches off there to supply refineries at Szoeny, on the Danube river; at Pet, on the eastern shore of Lake Balaton; and the refinery at Csepel, south of Budapest. The pipe line is said to transport both crude and natural gas on an alternating basis.

An $834,000 natural gas pipe line connects Gellenhaza and Lovaszi, required by the lack of gas at Gellenhaza.

An unconfirmed report says crude from the newly-found Lendava-Ujfalu field, near Lovaszi, is transported through a new line to Lispe from whence it enters the major Hungarian pipe line to Soifok.

The Nagylengyel pipe line to Zalaergerszeg, where a refinery was begun in 1951, probably has been completed.

Refining. Total Hungarian refinery capacity last year was estimated at 21,364,000 barrels, which exceeds the 1955 crude output of 12,208,000 barrels by 9,156,000 barrels.

It is known that large quantities of Austrian crude were shipped by the Soviets to Hungary for re-export to Czechoslovakia, Bulgaria and Poland —not for Hungary's domestic requirements. These Austrian shipments are scheduled to continue at an annual rate of 9,156,000 barrels for the next five years, and at an annual rate of 7.5 million barrels until 1965.

By then, Hungarian production may have reached the 19,075,000-barrel level—if Western opinion that Hungary's oil fields will be depleted prematurely due to an overly-fast development becomes a reality.

No information was available concerning the jointly-built Hungarian-Rumanian petrochemical plant at Tiszalo, near the Rumanian border, where Rumanian natural gas from the Transylvania area was to provide raw material for the Hungarian plant. This plant was scheduled to start operating at the close of 1955, but no statement was released on the start of operations.

The 1955 increase in refining capacity stemmed from enlargement of the Csepel refinery and the reorganization of the Petfurdo plant. The Komaron (Almasfuzitoe) refinery also was to have been enlarged, and the Szoeny refinery was to be fitted with a new cracking unit.

Exploration. The State Production Plan for 1956 called for a 40 percent increase in the number of completed wildcats from 1955. That order came at a time when 1955 production of 12,208,000 barrels was to be boosted by another 6.6 percent during 1956.

Hungarian sources said July 10, 1955: "Speaking of oil, so far we have mined this mineral at known places like Lispe, Lovaszi, and Nagylengyel, in the Trans-Danubian area. Alongside these known areas, our geologists are now searching new areas. We can more or less see drilling rigs doing exploratory drilling in almost all parts of the country. Regular research work is going on in Mezoekoevsed, Mezoecsat, Mezoekeresztes, Biharnagybajom, Szolnok, and their environs. Along with oil we are also searching for gas."

Work also is going on in the Buekk mountains and in the area east of Miklosz. The latter area was being subjected to study for the second time —since 1930 tests indicated oil, but none has been found.

At Felsoerajk exploration work was expanded during 1955 and reached into the Kiliman-Pasca area. One reliable Western source said from first-hand knowledge that rigs are spaced about 1½ to 2½ miles apart and that 25-man crews operate around-the-clock.

Latest Field Discoveries. The major oil field discovery during the past few years was at Nagylengyel. Located in the Goecsej district, this field was discovered in 1951 and has become the best in Hungary. Production is found at 6562 feet.

Well 23 at Tatarfoeld discovered oil on Sept. 15, 1955. Located near the Semsa river in the Zala district, the test found crude at 3609 feet.

New wells drilled at Mezoetur have resulted in production that exceeds Lispe oil field. Other fields, discovered prior to 1955, include:

- Gellenhaza, which is located 12 miles south of Zalaergerszeg, was found in 1952. Four wells were in operation at the end of 1952. Producing depth is 7874 feet.

- An oil field 35 miles west of Komlo village which is described by official Hungarian sources as a "considerably large" field.

- A field near Mezoekeresztes in

northeast Hungary was found in 1953-

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northeast Hungary was found in 1953-1954.

Geophysical. Geophysical activities are directed from the Lorand Eoetvoes Institute for Geophysical Research, an agency of the Hungarian Central Oil Administration.

Imports and Exports. Hungary's domestic requirements rest at about 10,682,000 barrels a year. Since no significant change in domestic consumption is expected, the annual increase will be approximately 7 percent. Hungary had about 1,526,000 barrels of products ready for export in 1955 from its own crude production, and, in addition, refined 9,156,000 barrels of products during 1955—providing utilization of all refineries was 100 percent.

This would tally up to 10,682,000 barrels of products available from Hungarian territory during the year. Orders for delivery to Finland, Bulgaria, East Germany, and Czechoslovakia were extended to Hungary through the Council of Mutual Economic Assistance clearing house in Moscow. It can be assumed that products exports will increase during the next few years.

Labor, Housing, Roads. About 50 miles of roads are being built or repaired in Hungary each year, thus encouraging the transportation of goods by motor vehicles. Private vehicle ownership is very rare and depends directly on the owner's rank and job, his party affiliation and standing in the socialist economy.

Increases in freight hauling on roads can be expected since the domestic coal mines cannot serve domestic requirements completely.

Forecast. A further increase in crude production can be expected if the current production level is not the result of overly-fast development. Since crude reserves are available for continued drilling, material is the governing factor over future production.

Without Russian help, Hungary must pay the high prices for equipment from the USSR. On the other hand, Hungary's 1,526,000-barrel crude surplus probably will pay for all required material. With Russian refining capacity very much on the "short side," Hungary might have a chance once the Austrian deliveries of crude oil to Russia cease. —**The End**

Full-Scale Ragusa Field Development, Production Drawing Near in Sicily

Production-wise, the prospects of Sicily's Ragusa field are bright:

- During the first half of this year, crude output reached 1,685,000 barrels as compared with 578,000 barrels during the corresponding period of 1955 and 280,000 barrels in 1954's like period.
- Natural gas production during the first half of 1956 amounted to 78 billion cubic feet as compared with 60 billion cubic feet in the same period of 1955 and 51 billion cubic feet in the first six months of 1954.

The 14-inch, 37-mile oil pipe line which will connect Ragusa field with the Augusta refinery has been more than half completed. The pipe line will permit the maximum development of the oil producing area with its 11 producing wells in operation.

The opinion was expressed that with the completion of the pipe line, output from Ragusa would approximate 6 million barrels. Further, it was suggested that if production from two more wells which have been completed recently is included, production by December may reach the annual rate of as much as 7.7 million barrels.

Meanwhile, Gela 1, a wildcat in the Gela-AGIP research permit area, has found an oil showing between 9954 feet and 10,059 feet. No details were available.

Dry Hole Limits Border Of Nahorkatiya Oil Area

Assam Oil Company's Well 15 in Tengakhat, Hugrijan prospecting license area, has been completed as a dry hole. Since mid-1953, 18 wells have been completed in the alluvial areas of the Brahmaputra Valley of Upper Assam. Among these, four wells, including Tengakhat 15, were failures.

Equipment from the latest test was to be removed to Langkasi, a new location in the Hugrijan area, as soon as the hole had been pluged with cement.

The effect of this failure is that the extent of the oil bearing area to the northwest of the original discovery well at Nahorkatiya is less than was expected. Meanwhile, Well 19, situated north of the discovery well, was drilling ahead. Work on other new locations also was in progress.

Arrangements to test Well 1 at Moran, between Sibsagar and Lakhimpur subdivisions, were being readied. It is the deepest well drilled in the subcontinent at 13,739 feet.

Russian Oil Delegation To India Issues Report

Recommendation that exploration in India be concentrated in the Punjab and Rajasthan was made by a team of Russian experts who conducted a reconnaisance survey of the nation early this year. Other areas recommended for investigation were the Ganges Valley, West Bengal, Cambay, Uttar Pardesh, and the Madras Coast.

Seismic coverage was recommended for 16 areas, and core drilling in 13 others. Gravity and magnetic surveys of 176,000 square miles, and geologic mapping of 11,400 square miles also were recommended. Deep drilling was suggested in six Punjab areas, in Jaisalmer, the Ganges Valley, and West Bengal. Organization of 14 gravity, 10 seismic, 14 geological, 5 core drilling, and 5 deep drilling crews was recommended.

Plans to Use Sylhet Gas In East Pakistan Discussed

Plans to use Sylhet gas for industrial development in East Pakistan were under consideration by the East Pakistan Government and representatives of the Planning Board.

In announcing this, Pakistan Petroleum Ltd. said that at the invitation of the Planning Board representatives of the natural gas industry held preliminary discussions in Dacca with officials concerned.

Rough estimates of the quantity of gas likely to be recoverable from the Sylhet gas field have been given to the authorities, and provisional planning was proceeding on the basis that the field's resources were sufficient to meet local needs for 30 years to come.

Drilling operations at PPL's Well 2 at Sylhet were still in progress when the discussions took place but the company has made available all the

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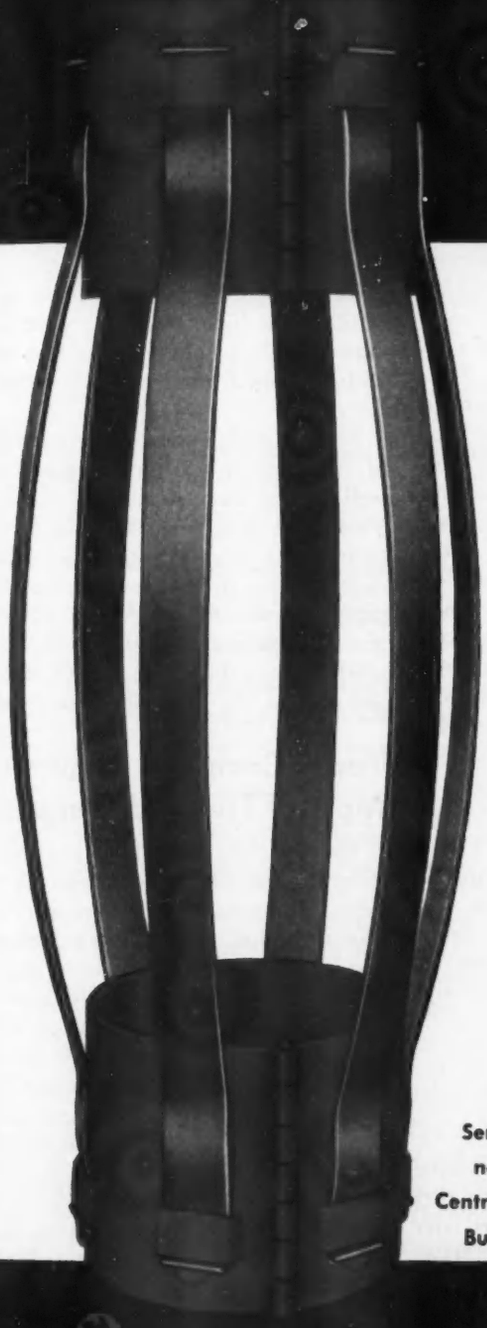

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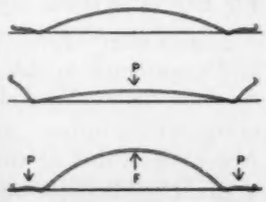

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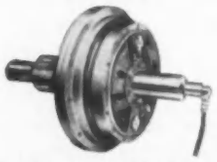

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information it had about Sylhet gas at the time. One of the major points considered was the cost of gas transmission to industrial consumers in the east wing of the nation, and tentative cost estimates were provided based on Sui Gas pipe line experience in West Pakistan.

Since the distances involved are less than in West Pakistan, it was expected that the cost of Sylhet gas would be appreciably less than that of other fuels.

New York Firm Acquires Major Panama Concession

The Cataract Mining Corporation of New York has acquired exploration and development concessions for a 2 million acre area in the Republic of Panama. The announcement was made by H. J. Steel, executive vice president, this week.

Cataract Mining will operate through a local, wholly owned subsidiary, Compania Catarata de Petroleo Panama S. A. The concession is located in the Province of Chirique near the border with Costa Rica, close to similar concessions held by the Union Oil Company of California. Union had a producing well come in recently just across the border in Costa Rica and planned to test drill on the Panama side of the border. Cataract was scheduled to start test drilling.

The Union Oil Company strike near the Panama border in Costa Rica has stimulated interest in oil deposit potentials in Panama. At least 15 major U. S. oil companies are either attempting to acquire or have acquired concessions from the Republic of Panama recently.

38 Exploration Permits To Be Granted By Italy

The Italian Ministry for Industry and Commerce in Rome has decided to grant 38 exploration permits covering 4180 square miles in Italy. About one-third of this area will be granted to ENI-group agencies and the rest to private firms. Two-thirds of the acreage involved is in southern Italy.

Gulf Italia reportedly will not accept exploration permits until favorable oil legislation might be enacted in Italy. It has indicated previously that if the current legislation passed by the Chamber of Deputies is passed by the Senate and becomes law, Gulf may pull out of Italy entirely.

New Deep Oil Discovery In East Venezuela Reported

A deep oil discovery in the Greater Oficina area of western Monagas in Eastern Venezuela was announced by Venezuelan Petroleum Company, subsidiary of Sinclair Oil Corporation. Aguasay 3 bottomed at 14,221 feet and tested 689 barrels of 35-gravity oil from "one of the lower sands."

Sinclair has not divulged the exact producing depth but said the aggregate pay thickness exceeds 200 feet, with several more promising pays yet to be tested. The discovery is on a 92,600-acre block. A spur pipe line may be built to connect the new well with a 16-inch crude line 30 miles to the north.

Sinclair also announced completion of Venezuelan's fifteenth producing well in the Barinas field of Western Venezuela. The wells have an aggregate initial potential of 17,000 barrels daily. This production is awaiting pipe line outlet to Puerto Cabello, and completion of the line is scheduled for mid-1957. Four drilling rigs are now active in the Barinas field.

Texas Company Acquires Most of Trinidad Company

By September 6 The Texas Company had acquired more than 95 percent of outstanding Trinidad Oil Company Ltd. capital stock, completing its acquisition of the latter's properties. The Texas Company, now the second largest crude producer in the U. S., will take over large acreage holdings in Trinidad, including Trinidad Oil's 25,000 barrels daily crude production. The modern 80,000 barrels daily refinery in Trinidad and port facilities at Pointe-a-Pierre formerly owned and operated by Trinidad Oil Company will be added to The Texas Company's far-flung operations.

Trinidad Oil markets in Trinidad, Jamaica, Puerto Rico, Dominican Republic and other Caribbean Islands, in the United Kingdom, Eire, and Canada, through its various subsidiaries and affiliates. Trinidad Oil also has a fleet of owned and chartered tankers.

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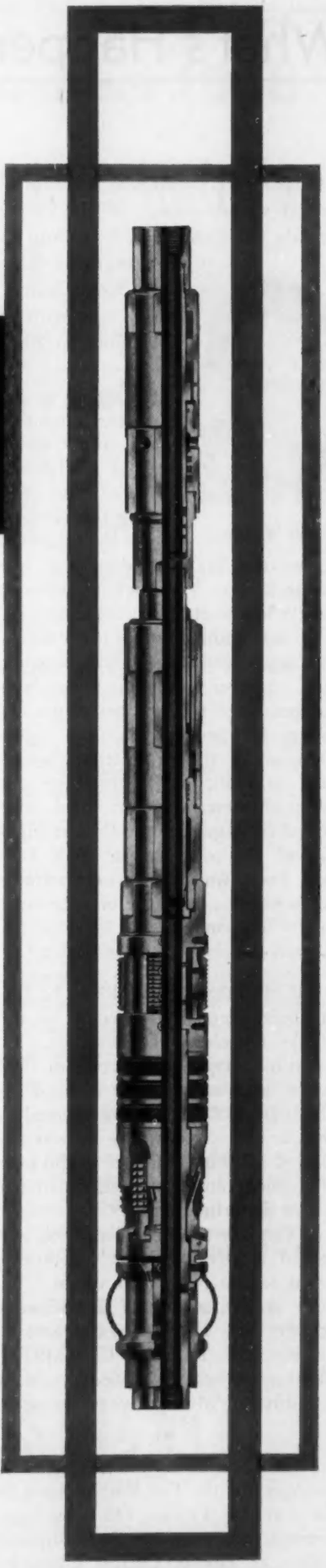

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What's Happening

AMONG WORLD OIL MEN

CLIFF W. PEERY has been elected vice president of the Mene Grande Oil Company. A veteran of 22 years service with Mene Grande, Peery was born in Oklahoma in 1911. He received his B.S. degree in petroleum engineering at the University of Oklahoma in 1933 and, following the employment by Gulf Oil Corporation the succeeding year, was sent to Eastern Venezuela as geologist for the Venezuela Gulf Oil Company.

Cliff W. Peery

He was transferred to the Production department in 1937 as a petroleum engineer, and two years later was promoted to chief petroleum engineer. He became assistant superintendent of the Production department in 1940, and in 1949 became general superintendent and was named manager for the Eastern division of the company in 1951. Last year, Peery was transferred to Caracas to become manager of operations for the company.

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NICHOLAS J. CAMPBELL, JR., has been elected a director of the Creole Petroleum Corporation. He began his service with Creole in 1947 as an attorney in the New York office. In 1950 he was transferred to the Caracas office, where he was appointed assistant manager of the Law department and was made manager of the department in 1953.

In January this year Campbell was elected a vice president and transferred to the New York office.

He is a graduate of St. Vincent College and Harvard Law School. He succeeds LLOYD G. SMITH, who has retired as a vice president and director after 43 years service.

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WILLIAM E. MURRAY, general manager for the Far East division of California Texas Oil Company, Limited, was awarded the Philippine Legion of Honor, Officer Class, by President Ramon Magsaysay at a recent ceremony in Manila.

The citation stated that the decoration was conferred because of Murray's "valuable services rendered in 1954 to the Philippine Economic Mission to the United States." The Mission was concerned with working out agreements that formed the basis for new legislation revising the 1946 Philippine Trade act.

Murray is also president of the Philippine American Chamber of Commerce.

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DR. JAMES A. TONG and H. R. MOORMAN have been elected president and executive vice president, respectively, of Socony Mobil Oil Company de Venezuela. Relinquishing the presidency of the Venezuelan affiliate is JOHN C. CASE, a director of the parent company and its vice president in charge of producing.

Dr. Tong has been executive vice president of the Venezuelan company. He joined Socony Mobil in that country as a geologist in 1934.

Moorman, until recently, was manager and executive vice president of Socony Mobil's Canadian affiliate, Mobil Oil of Canada, Ltd. He left that post in April to become a member of Socony Mobil's world-wide producing committee in New York. He assumed his new duties in Venezuela September 1.

•

E. F. LINDAHL and L. J. STURBOIS, Casper, Wyo., have been given new appointments by the Ohio Oil Company. Lindahl becomes manager of supply and transportation for the Oasis Oil Company of Libya, Ohio Oil subsidiary in Libya, North Africa. Sturbois succeeds Lindahl as production safety supervisor.

Oasis of Libya is the operator of Libyan concessions totaling 35 million acres held in undivided one-third interests by Ohio Oil, Continental Oil, and Amerada Petroleum Companies. Offices for the subsidiary are in Tripoli and Benghazi.

Lindahl was graduated from high school at Rawlins, Wyo., in 1932. He attended the University of Wyoming.

In 1941 Lindahl joined Ohio Oil, working in the Production department throughout oil fields in Wyoming, and Sidney, Neb. He was appointed safety supervisor of the Casper Production division in 1953.

Sturbois was graduated from West Virginia University with a B.A. degree in 1929.

In 1944 he joined Illinois Pipe Line Company of Texas, an Ohio Oil subsidiary, and in 1947 was transferred to the General Office in Findlay, Ohio, in accounting work. Since 1953 he has served two years in Ohio Oil's Houston division and a year and a half in the Casper division as personnel representative.

•

W. L. BUTTE and R. E. MAYS have been elected members of the Creole Petroleum Corporation board of directors, with headquarters in Caracas, Venezuela, replacing M. E. JONES and W. A. GREEVEN, who have resigned to accept positions with the parent company, Standard Oil Company (New Jersey). Also, D. E. STINES has been elected a vice president in the New York office. Stines will replace N. J. CAMPBELL, JR., who is leaving Creole to join the Law department of Standard Oil Company (New Jersey).

Born in Muskogee, Okla., Butte was graduated from The University of Texas in 1927 and received his LL.B. from Yale in 1931. He practiced law in Puerto Rico and Venezuela and was the first U. S. citizen admitted to the Venezuelan bar. He joined Standard Oil Company (New Jersey) in 1940 and has specialized in foreign law. He is a director of the Pan American Society, a director of the Ecuadorean-American Association, and chairman of the Council of the American Geographical Society.

Mays was born in Denison, Texas, and attended Southern Methodist University in 1928-29. He became a Certified Public Accountant in Texas in 1938. He joined the Creole Petro-

leum Corporation in Venezuela in 1949 as senior procedures accountant and subsequently held the positions of assistant comptroller and assistant manager of the Comptroller's department. In 1955, he was appointed manager of the Budget department in Caracas.

Stines was born in Sanitaria Springs, N. Y., and was graduated from Cornell University in 1929 with a degree in mechanical engineering. That year he joined Standard Oil Company (New Jersey) as a student engineer at the Bayway refinery in Linden, N. J. After extensive experience as a refinery engineer in the U. S. and England he became assistant manager of Export Sales for Creole in New York. From 1947 to 1952, he was head of the Coordination division of Standard Oil Company (New Jersey) Coordination and Economics department in New York. Next he became vice chairman of the Coordination committee for Europe. In 1955 he was named a special advisor on refining matters for Esso Petroleum Company, Limited, in London, the position he left to join Creole.

•

B. F. HAKE has been appointed general manager of Bolivian Gulf Oil Company and will be in charge of operations in connection with the exploration rights on over 7,750,000 acres in Bolivia which that company has acquired. Gulf Oil Corporation presently holds an 87 percent stock interest in Bolivian Gulf and Bolivian Gulf will report to Gulf's New York Exploration division.

Hake has 22 years with Gulf and recently has been special advisor for Exploration for Western Gulf in California.

•

JOHN R. DUNLAP, a resident of Libya, North Africa, has joined the Oasis Oil Company of Libya, a subsidiary of the Ohio Oil Company. He will be on the geological staff.

A native of Philadelphia, Dunlap was graduated from Utah State Agricultural College in geology. He later worked as a geologist in Tulsa, Okla., and New York City before joining Conorada Petroleum Corporation in Libya in 1954. Conorada, an organization owned by Ohio Oil, Continental and Amerada, conducted preliminary surface geology and laid the groundwork for negotiation of the Libyan concessions.

Published November 1956

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DRILLING HINTS

These **How-To-Do-It** Ideas Can Save You Money

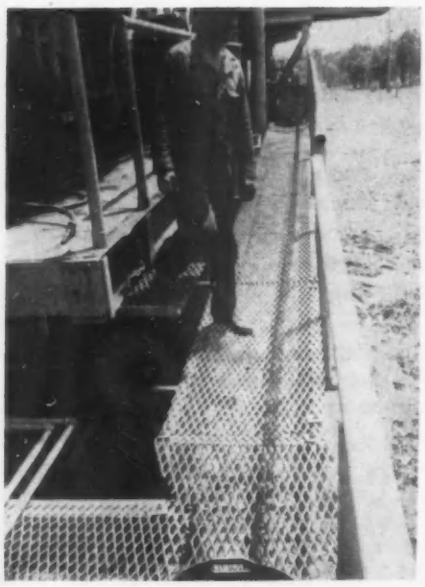
$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.

Use Top of Mud Tanks for Working Area

A compact work area around the rig is not only time saving, but adds to the efficiency because of better control by the driller. This is especially true of the mud tanks, mud house, hopper and mud testing apparatus. Some contractors are using the top of the mud tanks as a work area. This not only saves space but makes tank rolling, and mud testing, and sample catching quite easy from only one or two positions.

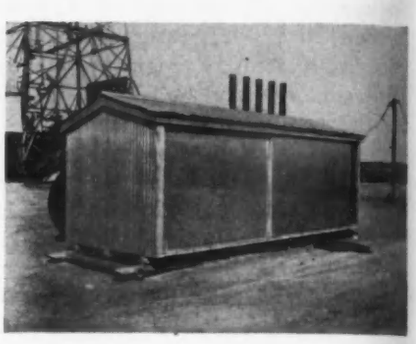
By covering all or portions of the steel mud pits with heavy steel mesh or expanded metal a work area is provided. In the illustration the contractor has covered a portion of his pit and placed his mud testing apparatus on it. This provides a safe, sure footing for the crew men and ready accessibility to the mud.

Provide Mud Ditch Catwalk With Grating



On barge rigs, where space is at a premium, to provide a walkway along the side of the rig, cover the mud ditch as shown. The mud tanks are placed at the back of the rig near the pumps and the combination walkway and mud ditch run along this side of the rig. The grating is made from floor plate material which provides a nonskid surface and also provides for easy inspection of the pits at all times.

The mud trough is first welded in place from the mud discharge line at the blowout preventer to the mud tanks. The grating is then cut to fit and is fastened to the trough with bolts which are welded to the edges of the trough. A large square washer is used to keep the nut from pulling down into the grate. The walks are then extended around the side of the mud tanks and the grating material is used in place of sheet steel to provide a clean, safe surface to walk on.



Side Doors on Core House Allow Maximum Space Use

Make more efficient use of space in the conventional skid-mounted core shed or tool house by equipping it with doors which open on the side instead of at either end. To further improve such a building, employ overhead-track sliding steel-clad doors.

Much valuable space that usually is lost by a corridor extending down the middle of the house is put to use in the side-door access unit installation shown. Equipped with shelves convenient for the storing of core trays, this particular unit was constructed of sturdy steel skid base, heavy plank

How-To-Do-It Ideas Earn Money, too!

$10—WORLD OIL editors want how-to-do-it ideas, so your favorite short cut or invention could put money in your pocket! Write down the substance of that latest idea and send it in with a picture or drawing of the installation . . . if accepted, $10 will be yours. Send those money-making ideas today to Hints Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.

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OIL TOOL CO.

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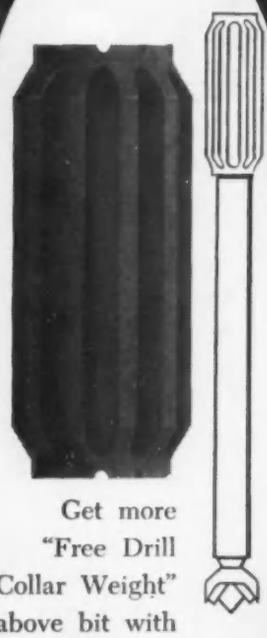

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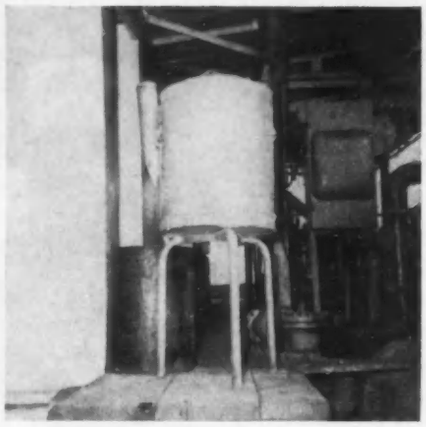
flooring and structure and corrugated iron siding and roofing.

It is weather-proof, easily accessible, and can be locked with hasp and padlock. Except during the night, the side opening feature also permits rapid inspection of cores in natural daylight when the geologist writes up his core record.



Provide Convenient Stand For Drinking Water Can

A drinking water can should be placed in a convenient place and at a convenient height for crew use. The illustrated stand is both convenient and attractive.

Construct the base of the stand from three pieces of metal pipe or tube which are welded to a circular piece of sheet metal. A rim around the circumference of the base keeps the water can from sliding off the stand.

Provide a rack for drinking cups and also a disposal can for used cups. These three features provide for the convenience of the crews, are sanitary and neat appearing.

Meter Records Water Used in Mud Make Up

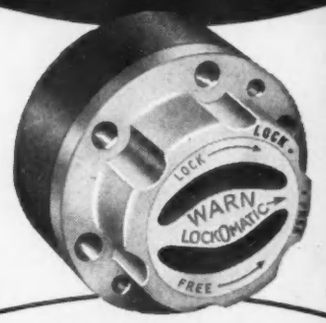
Place a water meter on the water supply line of a drilling well to keep an accurate record of the water that is being added to the drilling fluid for dilution purposes.

By the use of a water meter water can be added at a predetermined rate as the mud circulates. This keeps the mud from becoming too

GET MAXIMUM USE OF YOUR 4-WHEEL DRIVE!

SAVE ON EQUIPMENT... SAVE GAS, TIRES, REPAIRS

Warn Hubs on your 4-wheel drive make 2 vehicles out of 1, because you can use it as a light duty 2-wheel drive pickup, or 4-wheel drive work horse. Warn Hubs save gas, tires, repairs; stop front gear whine and shimmy in 2-wheel drive—and you have 4-wheel drive whenever needed. Automatically, too, with Warn Lock-o-matics! They select free-wheeling 2-wheel drive or tractive 4-wheel drive *as you shift!* When road conditions change, you just keep right on going *in whatever drive is required.* With Warn Hubs, whenever you use 2-wheel drive you're saving on operating costs — and because you have 4-wheel drive too, it's the only light vehicle you need! Lock-o-matic (and Locking) models for all makes 4 W. Ds. to 1½ tons. See Warn Hubs at your dealers, or write:



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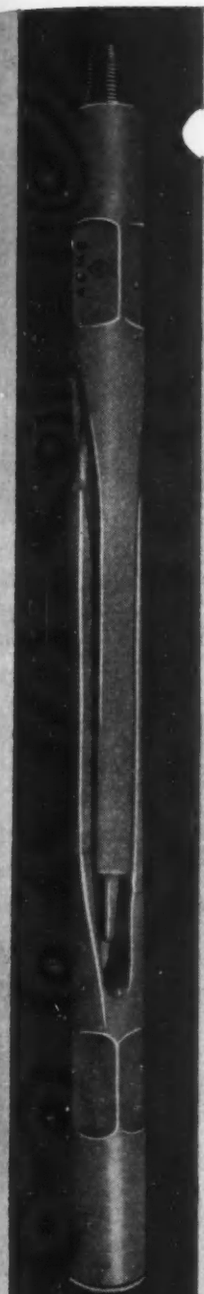

ACME ALLOY LONGER WEARING JARS

"are YOU getting ENOUGH FOOTAGE?"

1. To MAKE MORE MONEY you have to get a higher price for your drilling, or get more drilling from your machine and tools. The progressive drilling contractor is always after both—more money and more footage.

2. To get you MORE FOOTAGE, Acme spent more than a decade developing a superior alloy jar. How? By the same quality methods that have made the Acme Carbon Jar victorious over all competition. Today over 85% of the carbon jars made in America are Acme and they wear as long as a competing weldless jar in many sizes.

3. To get LONGER WEAR — much longer wear — in all formations, the Acme alloy jar has been perfected. Look up the word Acme in your dictionary; it comes from the Greek word, Akme, meaning perfection, peak of progress. Here is how we live up to our great name.

4. We have installed the MOST MODERN EQUIPMENT to manufacture jars. Exclusive with Acme are the latest technological improvements in the physical treatment and welding of jar steel. No one else offers you the benefit of such superior manufacturing facilities. Acme Alloy Jars — like Acme Carbon Jars — are superior because they are made by superior methods and machinery.

5. We use SUPERIOR STEEL in Acme Alloy Jars. It is a triple strength alloy steel, grade AISI 4340 made out of chromium, molybdenum, and nickel. It is a longer wearing alloy steel than the single alloy used in a competing make. Acme Alloy Jars have 1300% more alloy in them than any other make on the market. We use a chrome-moly-nickel steel which is rich in nickel, producing a greater depth of hardness penetration than the single alloy used by a competing make. LONGER WEAR is the bonus you get from the superior alloy steel in Acme Alloy Jars.

6. We use ATOMIC AGE WELDING methods. The welding techniques of today permit use of alloy steels far superior to those used at the time weldless jars were first made. The atomic age has made the weldless method obsolete. We put one electric weld in a set of Acme Alloy Jars. It is stronger than steel. The weld is X-rayed by an electro-magnetic process so that no bad welds can get past inspection. This one weld is in the crotch where the steel is 50% heavier than in the rein section. Both sections of the jars are drop forged. This method of making alloy jars enables Acme to use a superior alloy steel, and you get a superior alloy jar with less breakage and longer wear.

7. Acme, like its parent company, Stardrill-Keystone, has a basic policy of QUALITY FIRST. While another manufacturer of alloy jars uses an alloy steel containing only ⅛ of 1% alloy content, Acme, in its alloy jars, uses a steel containing 3% of alloy — or 1300% more.

8. Acme gives you MORE STEEL. For example our 5½" Acme Alloy Jars weigh 425 lbs. . . . 10% more than a competing make. At the same price.

SINCE 1900 **IN OUR 56TH YEAR**

VICTORIOUS JARS

ACME ALLOY JARS made of MOLYBDENUM CHROMIUM NICKEL Alloy Steel

ALLOY

3¼" Dia. $266.00
3⅝" Dia. $266.00
4⅜" Dia. $295.00
4¾" Dia. $319.00
5½" Dia. $360.00
6¼" Dia. $582.00
6½" Dia. $611.00
7" Dia. $752.00

Fig. 107AA

CARBON

2⅝" Dia. $168.00
3¼" Dia. $180.00
3⅝" Dia. $192.00
4⅜" Dia. $204.00
4¾" Dia. $228.00
5½" Dia. $258.00
6½" Dia. $550.00
7" Dia. $660.00

Fig. 107

And every Fishing Jar Size at the Best Price.

Every Fishing Jar size as well as every Drilling Jar size.
Acme Carbon Jars 6½" Dia. and larger sizes are made to heavy construction, similar to Acme Alloy Rein Type Jars, Fig. 107AA.
Acme Alloy Jars have more wearing stock than any other make.
All prices F.O.B. Factory, Parkersburg, W. Va.

Place your orders through your supply store or Dealer

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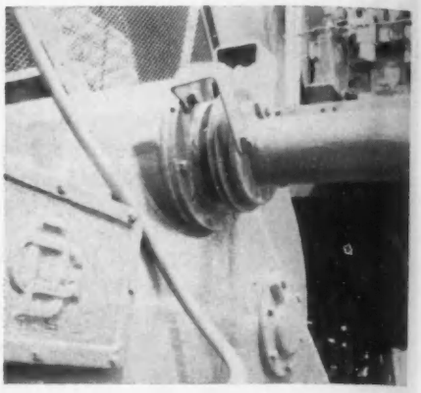
Complete information on Jars and other Acme Drilling and Fishing Tools is available in a FREE CATALOGUE. For your Copy, consult your nearest ACME DEALER or write direct to:

Acme Fishing Tool Company
PARKERSBURG, W. VA.
ESTABLISHED 1900
Greatest Name in Cable Tools
Tool Plant Division: STARDRILL-KEYSTONE
EXPORT OFFICE Stardrill-Keystone Co., Beaver Falls, Pa.

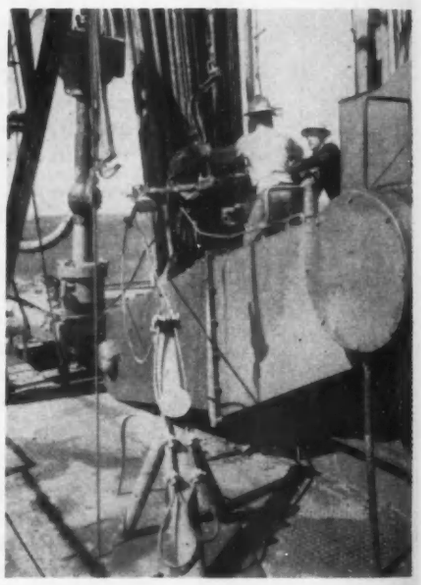
light in some spots as in the case where the watering is not closely controlled. Many rigs on the Gulf Coast are finding water meters a helpful tool in controlling drilling fluid properties.

Small Pump Sheave Guards Provide Adequate Safety

When the small pump used for the rod coolant on a mud pump is driven from the pinion shaft of the pump from a small sheave, provide adequate guards or protection on the sheaves for safety purposes. Crewmen working around the pump could get their clothing or fingers caught in under this belting and severe accidents could result.



Guards can either be a complete coverage as an enclosed belt and sheave guard, or they can be single pieces of strap metal bolted in place as shown in the photograph.



Two Back-up Lines Speed Round Trips

Rig up anchor post as shown to facilitate round trips. The line on the left is a simple anchor line which is attached to the back-up tongs when going into the hole, the tongs being on the bottom of the tool joint, and the power from the cathead for tool joint make-up is applied to the other tongs.

Coming out of the hole, the same tongs are used as breakout tongs and placed on the top tool joints. The wire cable shown on the right is anchored in the foreground and goes through a snatch block on the end of the tongs and hence to the automatic cathead. This gives twice the

"Pit-O-Graf"

RECORDS CONTINUOUS INSPECTION OF MUD PROGRAM

Continuous evaluation of the planned mud program by the driller is made possible by: 1., Instantaneous recording of mud pit level variations (as little as 2 or 3 tenths of one per cent in the entire mud system); and, 2, Pit-O-Graf is placed directly in front of the driller for easy observation.

Pit-O-Graf's continuous record helps prevent unnecessary losses of the drilling fluid. Gas or salt water incursions can be detected as much as an hour and a half to two hours before reaching the surface, giving the crew ample time to close the rams and prevent blowouts. Other information such as jetting mud to and from reserve pit, volume displaced thereby, and whether hole is kept full while coming out of the hole is also recorded by Pit-O-Graf.

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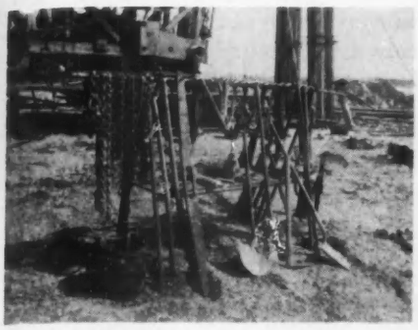
Export Representative: International Oil Equipment Co.
30 Rockefeller Plaza, New York City

power normally required on the breakout tongs and allows the same post to serve as anchor for both lines.



Make Handy Tool Rack With Sucker Rod Material

Make a tool rack that can be set near the rig for quick use of the tools from scraps around the welder's shop. It consists of a frame made of 1-inch pipe on which hooks are placed and a shelf in the bottom for oil cans and grease guns.

Make the end pieces with a saddle in the top in which a piece of 2-inch pipe is laid which carries the hooks. Hang the chains on a piece of sucker rod which is thrust into the top piece. Fasten the shelf by means of ears welded to the inside of the legs.

On short moves, the entire unit can be lifted to a truck bed with the boom poles, or the tools can be stacked and the stand taken apart where it will occupy a very small space.

Use Shopmade Tool Hanger For Convenient Storage

It's not always possible to have the necessary tools for doing a job close at hand.

The layout on the above well makes it inconvenient to run to the rig floor or tool house for tools whenever it is

Tips on Mud Valves for Toolpushers . .

Zack Taylor (right) and Toolpusher Jim Wilkson discuss the MUDWONDER on the standpipe of the Falcon-Seaboard Rig No. 9.

Mud Valve Economy, Easy Operation Found In Rockwell-Built MUDWONDER

by Zack Taylor, Division Manager
Falcon-Seaboard Drilling Company, Denver, Colorado

ECONOMY . . . Easy operation . . . Have you searched in vain for mud valves that would give you these benefits? We did until our experience with Rockwell-Built *Mudwonders*. Now, we use them on standpipes, mudlines, mud tanks, blowout preventers, etc. Eight months of testing and using *Mudwonders* proved to us that they are superior to any mud valve we have ever used, regardless of application.

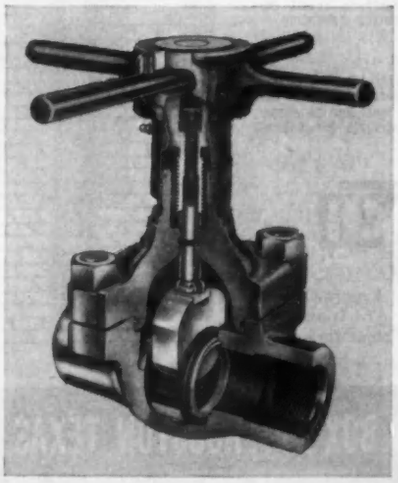
Economy means more to us than just long wearing parts which are inexpensive to replace. It means freedom from downtime and costly maintenance, too. *Mudwonder* valves give us "our type" of economy. We can inspect the inside of a *Mudwonder*, change the seat insert if necessary, and be ready for operation again while the crew makes a connection.

We never need a cheater or hammer on a *Mudwonder* valve. Easy operation is no longer a roughneck's dream. It's real . . . and at extreme differential pressures, too.

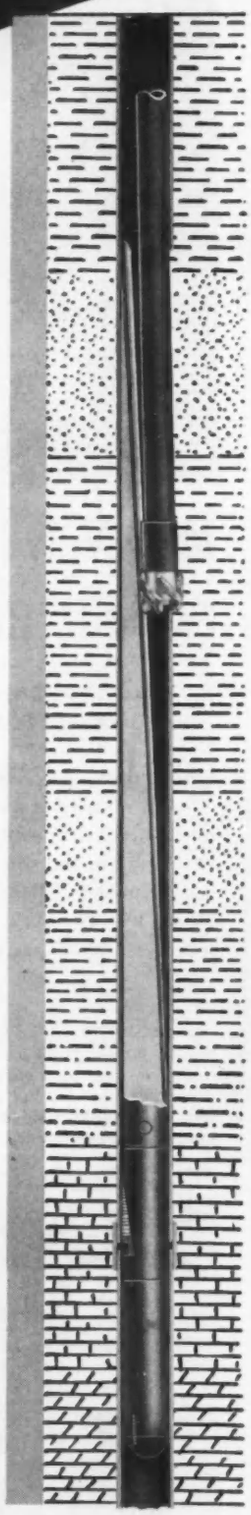
We can recommend *Mudwonder* to any toolpusher having mud valve trouble. *Mudwonder* valves are built in 2", 3", and 4" sizes with screwed or flanged ends for 2000 psi WP (4000 psi test) and 3000 psi WP (6000 psi test).

See your favorite oil field supply store for complete information, or write Edward Valves, Inc., East Chicago, Indiana. (Advertisement)

MUDWONDER cut-away view shows the double thread construction, separated stainless stem and hard chromed gate with "T" slot connection and the one-piece seat insert with the buna-N molded integrally over the steel wear rings.



NEW KINZBACH SPEEDMILLS
Slash
DOWN-HOLE CUTTING TIME



UTILIZING TUNGSTEN CARBIDE PARTICLES that continuously renew their cutting edges, new Kinzbach Speedmills offer you faster, surer milling under even rugged down-hole conditions. Because of their extreme hardness, they require fewer replacements . . . fewer round trips.

Kinzbach Speedmills require less torque for cutting . . . eliminate drill pipe wind-up . . . reduce shock on drilling string. They retain their high strength and hardness at elevated temperatures and are unaffected by heat generated by cutting action. Most important, the close control of speed and weight necessary in ordinary subsurface milling operations is not necessary with Kinzbach Speedmills.

For faster cutting . . . surer cutting, be sure your next milling job is done with Kinzbach Speedmills. Types available for every down-hole cutting problem.

Type 154 Speedmill

TYPE 154 SPEEDMILL
This mill is designed for attachment directly to a Kinzbach Type H Whipstock as the first tool in progressive milling operations. After the Whipstock is set, the attachment bolt is sheared and milling operations can begin. The lug on the face of the Whipstock engages the tapered pilot of this mill, forcing it to cut through the pipe wall without thinning the top section of the Whipstock. The Model 154 Speedmill is used to cut the first two and one-half feet of window only.

Type 155 Speedmill

TYPE 155 SPEEDMILL
After the first stage of window cutting is completed, the Kinzbach Model 155 Speedmill is run to complete the window. This tool is designed to utilize cutting force reactions so that maximum length of window may be cut, while side blades are designed to resist reduction in gage diameter during operation.

TYPES 156 AND 159 SPEEDMILLS
For general and milling operations. Used to mill up pipe or tools in the well and to shape the ends of obstructing materials for subsequent fishing operation.

Type 159 Speedmill

Type 156 Speedmill

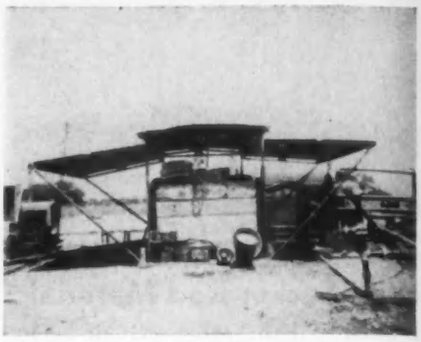
KINZBACH TOOL CO INC

Export Office:
74 Trinity Pl.
New York, N. Y.

KINZBACH TOOL CO., INC., P. O. BOX 277, HOUSTON, TEXAS

DRILLING HINTS . . .

necessary to repair the pump. Weld pins to the mud tank walk-around, thereby providing convenient tool hangers where workmen have to move only a few feet in order to obtain or hang up a tool.



Save Drilling Materials From Weather Damage

To keep drilling mud materials from weather damage, construct a collapsible mudhouse which is substantial but folds up to be portable.

Construct the top and sides from pipe and cover them with sheet metal. The sides are hinged and can be propped up to give maximum ventilation. The pole frame is set up on a wooden floor. The ends of the mudhouse are built up with boards.

Make Mud Pit Crossover From Two Pipe Lengths

A means of crossing a mud pit can save steps. Also a means of gaining easy access to the mud in the middle of the pit is sometimes desirable.

Boards laid across the pit could be dangerous as they become slippery when wet. They are also difficult to secure. Build a safe and sane pit crossover by welding two lengths of pipe in place across the pit about two feet apart and laying steel mesh across the pipes to form the walkway.

Your Wickwire Rope Distributor and our metallurgist... work together for you

This metallurgist—who is responsible for the quality of our rope wire—is with your Wickwire Distributor every time he makes a call.

True, he's physically in his laboratory, supervising the thorough testing *of both ends of every coil* of wire to assure uniformity throughout the coil. But, whenever your Wickwire Distributor calls, he has the full assurance that metallurgists like this are constantly making sure that the product has the right chemical and physical properties to give long, dependable service.

It's just one more reason why your Wickwire Distributor knows he's got top-quality wire rope, slings and strand to sell . . . and that these products will serve you well.

CF&I WICKWIRE ROPE A CF&I PRODUCT

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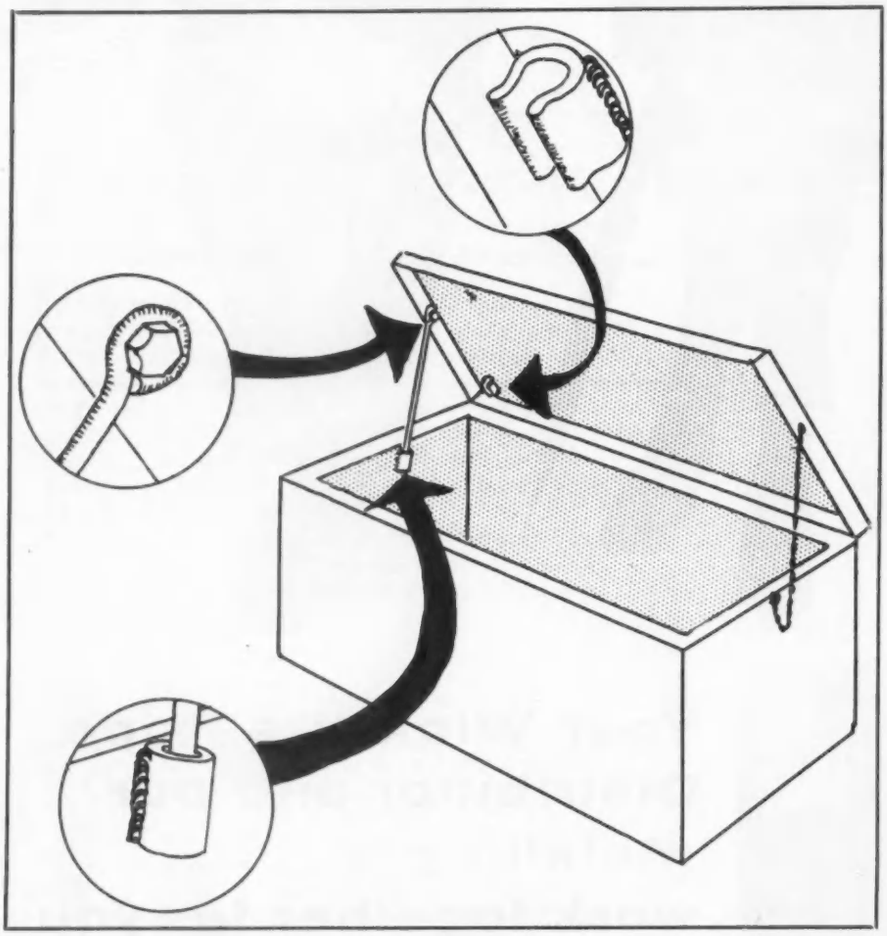
PRODUCTION HINTS

These How-To-Do-It Ideas Can Save You Money

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.



Install a Prop for Tool Box Lid

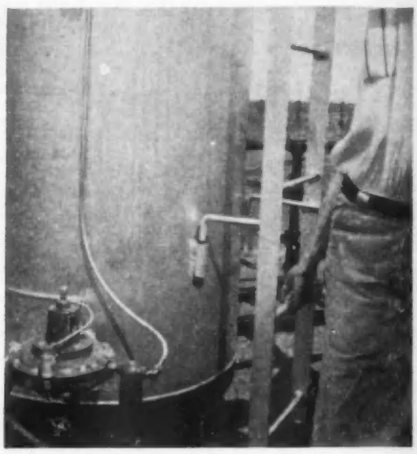
How many times have you had the heavy lid on a large tool box fall on your hands, arms or head while you were working? An easy, inexpensive way to eliminate that difficulty is to install a lid support like the one in the sketch.

To make this device, form a small loop in one end of a piece of small gage steel rod long enough for your particular job. Attach the rod to the lid of the box by inserting a bolt through the loop in the rod and through the lid as shown. Leave the nut loose enough to allow free movement of the rod. Be sure to use whatever washers are necessary for adequate support and smooth operation.

Cut a short piece of pipe with an inside diameter slightly larger than the O.D. of the rod and weld one end shut. This part will act as a well for the rod when placed as illustrated.

The clip for securing the rod when the lid is closed can be made from sheet metal and attached to the inside of the lid. The final attachment is the chain which restrains the lid and prevents it from opening too far.

In addition to the safety feature this device allows you to work with both hands as is often necessary with heavy tools or equipment.



Attach Simple Ladder To Separators, Treaters

The photograph illustrates a very simple method of attaching a ladder to separators, treaters or tanks of any sort.

To reproduce this attachment, cut four pieces of ⅝-inch or ¾-inch steel rod about 10 inches long. Bend the

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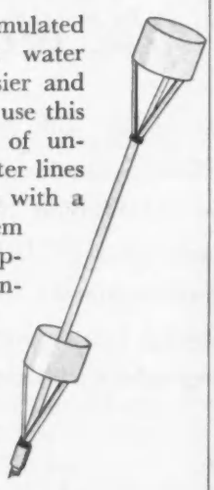
rods 90 degrees about two inches from the end. By welding the long, straight end of the rods to the inside of the vertical metal supports of the ladder, as shown, you have fabricated the male half of the attachment.

The female half, which is welded to the tank, is made of a piece of steel pipe about two or three inches long. The inside diameter of the pipe should be 1/16 to 1/8-inch larger than the outside diameter of the rod. This will provide the necessary tolerance to make the assembly of the unit an easy matter.

An additional consideration which will simplify the attaching process is to stagger the top and bottom sets of rods on the ladder. By proper placement, it is possible to start the bottom set into the pipe nipples first and after they are started the top set are in position to start into their respective sockets. This keeps you from having to line up all four of the rod supports at once.

This method of attachment is safe, fast, simple and inexpensive and allows one ladder to be used on several installations.

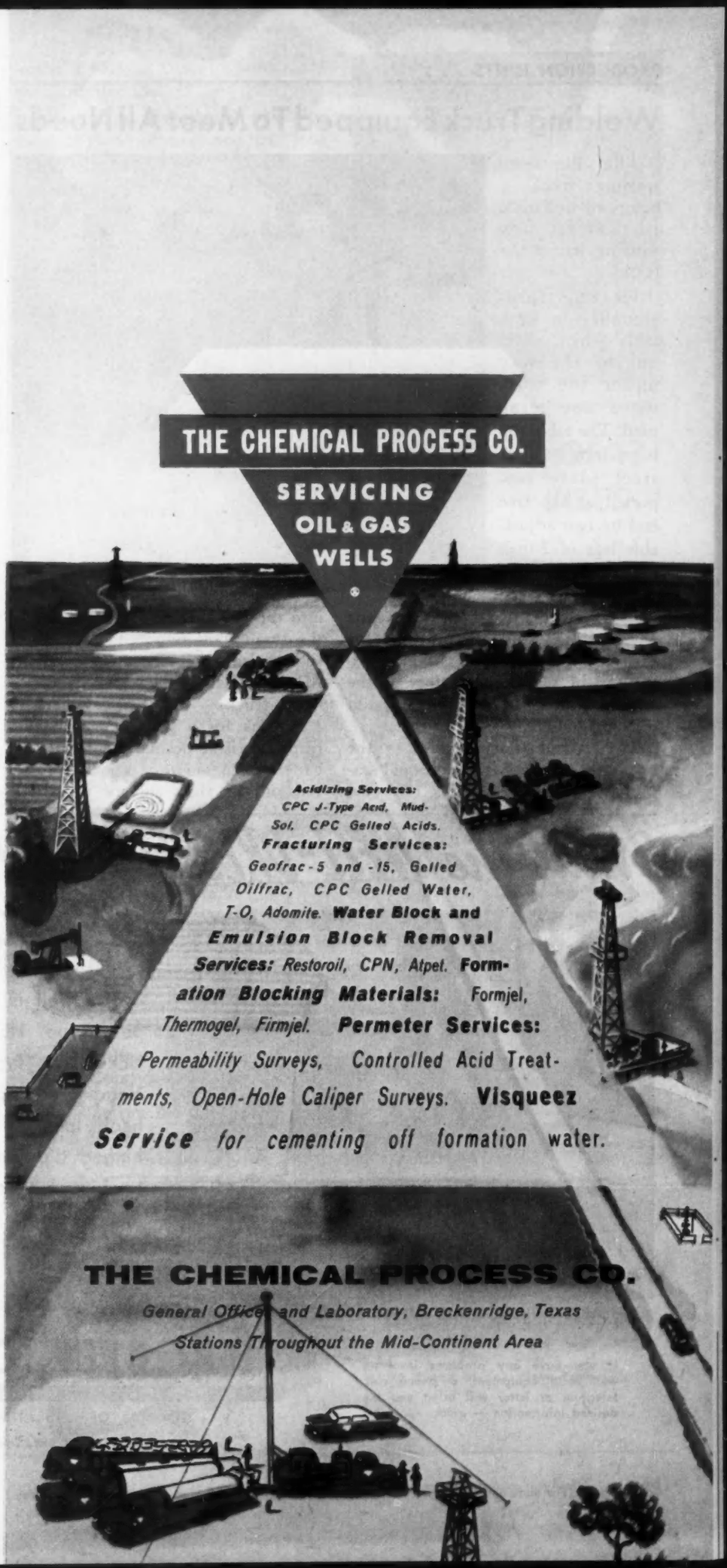
Sucker Rods and Scraper Clean Salt Water Lines



To clean the accumulated deposits from salt water lines and do an easier and more thorough job, use this suggestion. Instead of uncovering the salt water lines and pounding them with a hammer, scrape them with a simple shop-made scraper. Construct the scraper with dimensions being dependent upon the size of pipe in which it is used. Place the scraper inside the pipe to be cleaned and attach sucker rods to it. In this manner the scraper is pushed through the line and retrieved.

A considerable saving in time and pipe have resulted where this cleaning method has been used.

(Submitted by an employe of Humble Oil & Refining Company.)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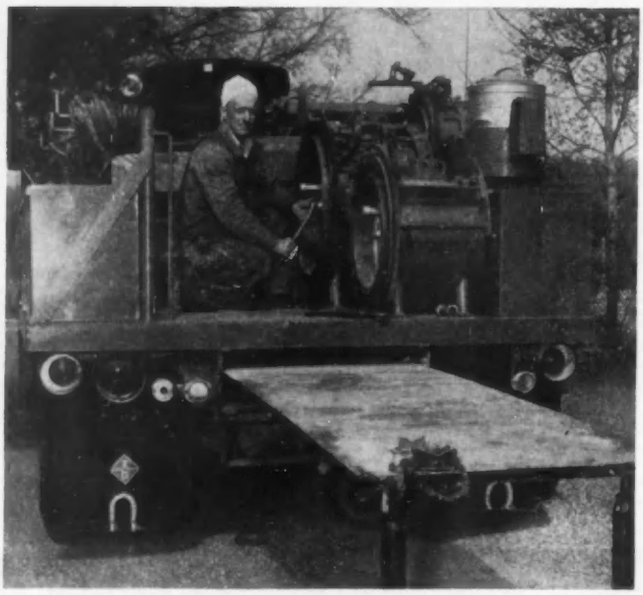


The illustrated welding truck is equipped to handle just about any welding job in the books.

In the foreground is a work table which slides out of the way under the truck when not being used. The table top is made of ¼-inch steel plate supported at the free end by two adjustable legs of 2-inch pipe. To attach the legs and provide the adjustment, two 1-inch hex nuts and a 1-inch stud are provided for each leg. One hex nut is welded to the top of the leg, the other to the bottom of the table, and the stud joins the two.

Weld small square plates to the bottom of the legs for additional stability. When the table is retracted into the truck, remove the legs. Store the small tools required on a job in sliding drawers built into tool boxes. Mount these tool boxes on each side of the truck.

A rack for a water can and cup dispenser is a permanent fixture. It can be seen mounted above the tool box on the right side of the truck. Racks for 18- and 26-inch beveling machines are attached to the truck bed. A 12-inch beveling machine rack is attached to tool box on the right in front of the water can.

Oxygen and acetylene cylinders are made easily accessible in front of the tool box on the left side. The ground cable and lead cable racks are seen at the left. They are made of bar stock welded to a 2-inch pipe frame.

Together these parts form a unit that adds speed and accuracy to every welding job.

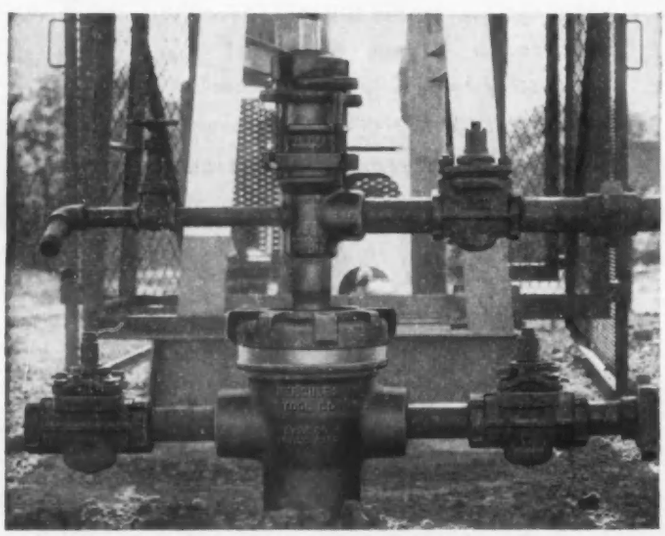
Protect Engine Panels With Shopmade Pipe Rack

It is a common practice during hot weather to remove the side panels on an air cooled engine to provide extra cooling. During this time or when the engine is undergoing repairs it is beneficial to have a rack on which to store the panels. This greatly reduces the possibility of the panels being damaged.

One example of such a rack, constructed by a gager, is shown below.

The rack consists of a 5 foot length of 2-inch pipe, a 2½-inch pipe collar and 18 inches of 1-inch by 1-inch angle iron. Drive the pipe into the ground a foot or so. Weld two pieces

What the WELL-DRESSED, MEDIUM-PRESSURE Wells are wearing



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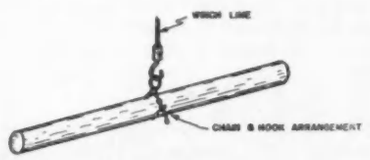
of angle iron about 6 inches long to opposite sides of the pipe about a foot from the ground. This forms a groove into which the bottom of the panel can be fitted. The top of the panel is held in place by similar pieces of angle iron welded to the collar.

When the collar is slipped over the pipe it falls freely till the angle iron fits over the top of the panels. This holds the panels securely in place and allows them to be removed quickly and easily when needed.



Lift Fragile Objects With Chain and Hook

It is a common practice when lifting an object with a winch line, to wrap the line around the object to be lifted thus, getting a secure hold. This practice, however, has a tendency to crush fragile items of equipment such as heater stacks during lifting operations. To prevent damage to such items, a chain and hook arrangement has been designed for use with a winch line.

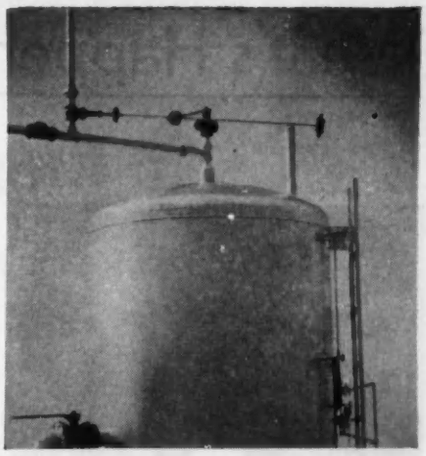
Make the unit of a 2½-foot piece of ¼-inch chain with a small hook attached to each end and a large ring which fits over the winch hook attached to the middle link. The two small hooks at the ends of the chain allow it to be attached to the object to be lifted as tight or as loose as desired.

Handle Extension Puts Valve Within Reach

To reduce hazards caused by "just-out-of-reach" valves and allow the operator to work from his ladder, use the illustrated idea.

Make a simple handle extension from a piece of steel rod cut long enough to extend from the valve to the ladder. Weld a tubular stand with a guide sleeve to the top of the tank as a support for the extension rod. Braze a second and somewhat larger handle to the end of the rod and the extension is complete.

Now the valve can be operated from the ladder without difficulty, and another job is made a little safer.



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What's Happening

AMONG MEN IN THE INDUSTRY

J. C. Traylor

W. P. Larkin

The T-L Drilling Co., Inc., was recently formed in Houston by two veteran oil men, **W. P. (Foots) Larkin** and **J. C. (Jimmie) Traylor.** Larkin started his career as a roughneck in the oil fields in 1928, and for the past 17 years has held supervisory positions with both contractors and independent operators in Texas, Louisiana and the West Coast. Traylor has had 25 years experience in the industry with a major oil company and a major service company in various capacities.

•

W. A. M. Greeven has been elected a director of **Esso Export Corporation,** in addition to his current post of deputy coordinator of marketing for **Standard Oil Company (New Jersey).** Greeven has served Jersey Standard companies for 31 years, 20 years of which have been devoted to overseas posts.

•

W. C. Summy, former assistant division production superintendent in **Sinclair Oil and Gas Company's** Houston office, has been transferred to Sinclair Oil and Refining Company as superintendent of its Santa Barbara, Venezuela, operations.

•

E. J. Bartosh, for the past 22 years geologist and petroleum engineer with **Bankline Oil Company,** Los Angeles, has resigned to enter consulting practice. He will be located at 1851 Hill Drive, Los Angeles.

•

George B. Hargens has been appointed to the new position of assistant vice president in the Marketing department of **Standard Oil Company of California.** Hargens, previously manager of the Marketing Research division and assistant to the vice president in charge of marketing, has been with Standard of California for 22 years. He started with Standard in various clerical jobs in the Marketing department. After a series of advancements he was named special assistant to the vice president in charge of marketing in 1947, and, in addition, became a director of Standard Oil Company of British Columbia in 1948.

•

Standard Oil Company (Indiana) board of directors announced election of two executive vice presidents, a manufacturing vice president, two additional vice presidents, and two directors. Four of these seven positions are newly created. **John E. Swearingen,** vice president in charge of production, and **Dr. Robert C. Gunness,** general manager of supply and transportation, were elected executive vice presidents. Swearingen's primary responsibility will be the coordination of activities of affiliated companies with the parent company. Dr. Gunness will direct and coordinate the activities of the manufacturing, sales, and supply and transportation departments. The retirement of **Dr. Max G. Paulus,** vice president in charge of manufacturing since 1933 and a director since 1932, after more than 41 years' company service, was also announced. **Samuel A. Montgomery,** general manager of manufacturing and a director since 1951, was elected vice president to succeed Dr. Paulus. **Thomas E. Sunderland,** general counsel, was elected vice president and general counsel. **Joseph K. Roberts,** general manager of the Research and Development department, was elected vice president in charge of research and development. **George V. Myers,** general manager of production, was elected a director, filling the vacancy left by the death of **Bentley G. McCloud. Jesse C. Ducommun,** assistant general manager of manufacturing, who will succeed Montgomery as general manager of manufacturing, was also elected a director, filling the vacancy occurring on the retirement of Dr. Paulus.

•

The Exploration Drilling Company, with headquarters in Tulsa, Okla., and area offices in Midland, Texas, and Denver, has advanced its two top officials. **Bailie W. Vinson,** formerly president, becomes chairman of the board and **B. E. Groenewold,** formerly vice president and general manager becomes president. For Groenewold, the promotion climaxes over eight years of service with Exploration Drilling. His first position was with the Cities Service Oil Company in Denver and later in New York City. This was followed by 14 years of service with The National Supply Company at Toledo, Ohio; Seminole and Tulsa, and Houston. With National, Groenewold, held the position of division engineer. Groenewold joined Bethlehem Supply Company in Tulsa in 1940 and served in the position of manager of engineering sales until he joined Exploration in 1948.

B. E. Groenewold

•

Edgar L. Cralle was appointed district superintendent, and **Keith Van Horn,** district engineer at Odessa, for **Cities Service Oil Company's** Production division. Cralle assumes the post of district superintendent vacated recently when **Don L. Kastner** was appointed assistant division superintendent for West Texas and New Mexico. Cralle was employed by Cities Service in 1947 in its engineer training program. Since completing his training, he has served as petroleum and district engineer at Oklahoma City and Graham, Texas, and spent two years as district superintendent of production operations at Pampa, Texas. He was district engineer at Odessa at the time of his advancement to district superintendent. Van Horn will succeed Cralle as district engineer, moving up to that position from a post at Russell, Kansas. Previous assignments were in the core laboratory at Bartlesville, Oklahoma, as roustabout at Hoisington, Kansas, as acting district engineer at Chase, Kansas, district engineer at Russell, Kansas, and as assistant to the division engineer at Great Bend, Kansas.

•

Nortex Oil & Gas Corporation announced the appointment of **Joe D. Nelson** as controller of the corporation and its subsidiaries. Nelson was employed by Peppers Refining Company from 1940 to 1950, leaving that organization as assistant controller to become internal auditor in January, 1956 from which position he has resigned to join Nortex.

Joe D. Nelson

•

Robert J. Beams has resigned as chief petroleum geologist and engineer for **Howell, Holloway & Howell** to enter independent oil business with headquarters in Dallas.

•

A. O. Savage, an assistant comptroller of **Standard Oil Company (New Jersey)** since 1949, has been appointed deputy comptroller of the company. Jersey Standard also announced the appointment of three assistant comptrollers. They are: **W. J. Edmonds,** formerly assistant to the comptroller; and **W. C. Jennings** and **H. W. Kull,** both formerly administrative assistants in the Comptroller's department. Savage joined The Carter Oil Company, a Jersey Standard affiliate, in 1936. After progressing through a series of accounting positions with various other operating affiliates, he was transferred to the Jersey Standard Comptroller's department in 1942 as an accountant.

•

Clarence F. Mantooh, formerly oil editor for the Tulsa World, has been named to the newly-created post of publicity for **Sinclair Oil and Gas Company,** Tulsa, Okla. He is succeeded as oil editor by **Riley W. Wilson.**

•

H. P. Schoeck, a director and treasurer of **Standard Oil Company (New Jersey)** has been named to the new post of executive development coordinator to assist the board of directors. He has been with Jersey Standard since 1917.

•

Alex W. McCoy Associates, Inc., Tulsa geological consulting firm, has employed **Wayne E. Swearingen** as chief engineer to head the newly established Engineering department. He was formerly with Stano-

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lind Oil and Gas Co. and Herman Kaveler, Tulsa, and has been active in consultant work as an appraiser of oil and gas properties for primary and secondary recovery.

•

Leo D. Welch, a director of **Standard Oil Company (New Jersey),** has been elected a vice president. He is well-informed on foreign exchange, having joined Standard in 1944 as treasurer after 25 years of banking experience, much of it in Argentina and Chile. In his new post he replaces **Jay E. Crane,** who retires as vice president, retaining his post as a director and member of the executive committee until his term expires in May, 1957.

Leo D. Welch

•

T. H. Tonnessen has been named assistant to the treasurer of **Standard Oil Company (New Jersey). V. J. Motto** became finance manager and **T. R. Lilley** was appointed investment manager.

•

M. D. Wallingford, formerly with Sinclair Oil and Gas Company, has been appointed assistant general counsel for **Warren Petroleum Corp.,** Tulsa.

•

F. C. McLarty has joined **Plymouth Oil Company** in its Sinton, Texas, headquarters office as assistant chief civil engineer. He was employed by The Goldston Company as civil engineer when he resigned to accept his new position. He also has been employed by Hudgins Thompson, Ball and Associates, The Austin Company, C. F. Braun, and American Smelting and Refining Company.

•

Joe B. Hudson, vice president in charge of exploration of **Monterey Oil Company,** has been named to the firm's board of directors.

Hudson, a geologist, joined Monterey in 1953 to head the exploration program of the exploration and producing company. Prior to that he spent 20 years with Humble Oil & Refining Company in exploration work in the South and Southwest and in Venezuela.

Joe B. Hudson

•

William T. Smith was named division geologist of **Stanolind Oil and Gas Company's** North Texas-New Mexico division. Prior to his promotion, Smith was district geologist and supervisor in charge of exploration activities in Stanolind's Abilene district. As division geologist, he replaces **John G. Voight,** who recently resigned. In 1948, Smith joined Stanolind as a geological scout in Wichita Falls, Texas, and has since served in various geological capacities at Fort Worth, Lubbock and Abilene. In his new capacity, Smith will have over-all responsibility for geological work in all of Texas except the Gulf Coast and south Texas areas; in New Mexico, southern Colorado and Arizona. **Lawson F. Jacks, Jr.,** replaced Smith at Abilene. Jacks joined Stanolind at Amarillo, Texas, in 1951, as a junior geologist, and, since that time, has served in various geological capacities at Fort Worth and Lubbock. He was serving as area geologist in Lubbock prior to this move. In his new capacity, Jacks will have over-all repsonsibility for exploration activities in Stanolind's Abilene district.

•

Husky Oil Company announced that **Maurice E. Smith** has been named vice president, finance, a new position in the company. He began his career with Husky

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in September, 1950, as an executive secretary.

E. J. Gemmill

John M. Armstrong

E. J. Gemmill was appointed assistant division manager for **Cities Service Oil Co.'s** Southwestern Exploration division and **John M. Armstrong** as southwestern division geophysicist. Gemmill steps into the new position of assistant division manager from the post of southwestern division geophysicist. He joined the company in 1935. He was transferred to Fort Worth as division geophysicist in 1951. Armstrong joined Cities Service in 1949. He served in various capacities on Cities Service seismic crews until 1953, when he was named district geophysicist at Midland.

•

Earl W. Russell has been elected secretary of **Standard Oil Company (Indiana)** to succeed **Laban E. Harmon,** who has retired on annuity after more than 34 years with the company. Russell, who has been executive assistant secretary, joined Standard in 1928 as a clerk in the Indianapolis, Ind., Sales division. In 1938 he was transferred as an analyst to the Sales Research department in the company's general office at Chicago. In 1942 he became office manager of that department. He was appointed administrative assistant in the president's office in 1946. In 1952 he was elected assistant secretary of the company and in 1955 was advanced to executive assistant secretary.

R. M. Foster

A. P. Yung

R. Mayson Foster has been appointed general auditor, and **Adam P. Yung** has been appointed manager of the newly formed Systems and Procedures division of the Comptroller's department, Gulf Oil Corporation. Foster, formerly functioning in a staff capacity in the department, will be responsible for the general supervision of all auditing activities throughout the company. He succeeds **P. Superty, Jr.,** recently elected assistant comptroller. Yung will be responsible for providing advisory service relating to accounting and office procedures including application of electronic machines and other office mechanization. Foster first joined Gulf in 1949 as assistant to the auditor in the New York Production division. Yung is a veteran of over 35 years of service, having first joined Gulf in 1921 as a clerk in the Philadelphia Sales division.

•

P. C. Spencer

Texas Pacific Coal and Oil Company, announced election of **P. C. Spencer,** president of Sinclair Oil Corporation, to Texas Pacific's board of directors. Sinclair recently acquired an approximate 30 percent stock interest in Texas Pacific, a domestic oil and gas producer with daily oil production of about 21,000 net barrels.

•

Husky Oil Company announced the promotion of **James R. Learned** to manager, Land and Exploration, and **M. F. Westfall** to manager of operations. Learned was general attorney for the company from 1953 to October, 1956. He has been with the company as an attorney since 1949. Westfall came to Husky from Cities Service Oil Company in 1952, as assistant production superintendent. He was promoted to acting district production superintendent in 1954, and to production superintendent in 1955.

•

Albert E. Bruggenmeyer, Jr., has joined the Administrative office of **International Petroleum Company, Ltd.,** as financial analyst. In 1952 Bruggenmeyer began his oil industry career with Standard Oil

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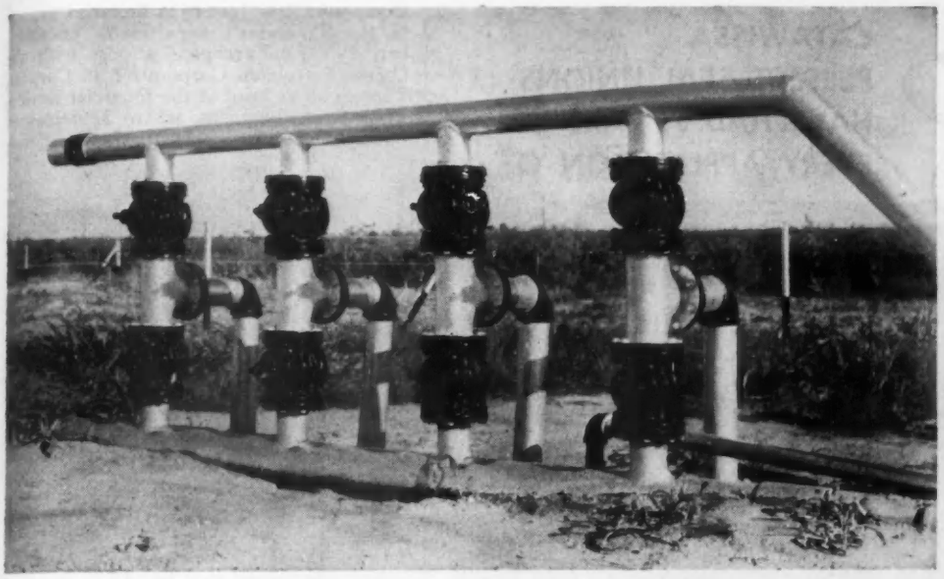

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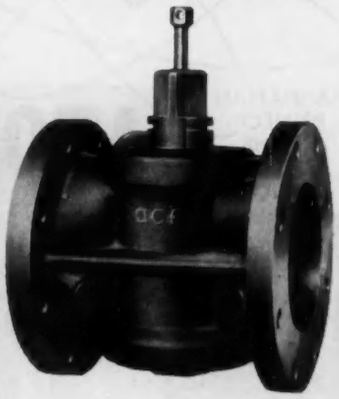
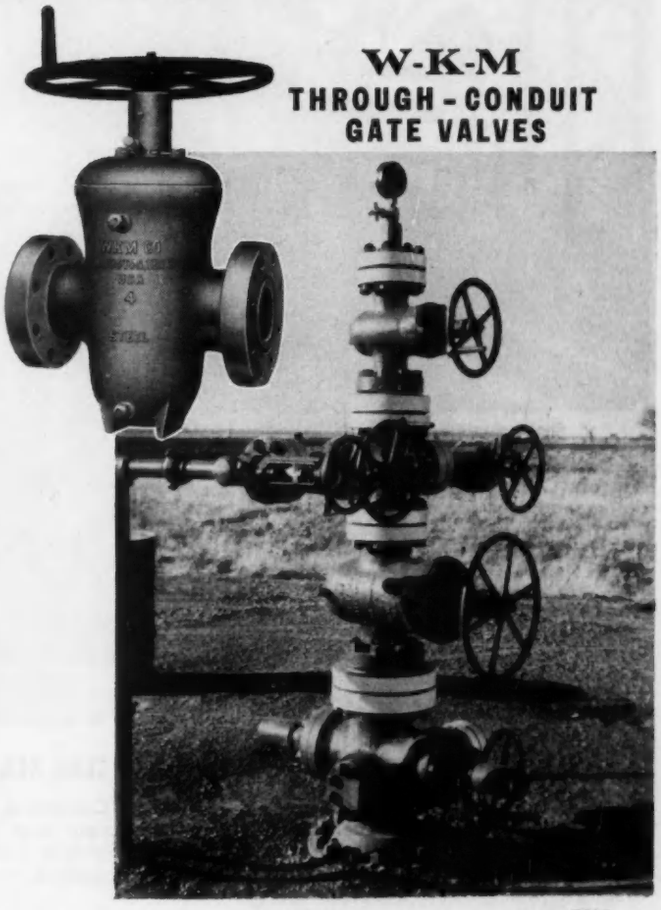


NOW-

Both High and Low Pressure Valves from W-K-M

W-K-M THROUGH-CONDUIT GATE VALVES



For your Christmas Trees, flow lines, and wherever else high pressures must be safely and positively controlled, there are the famous W-K-M- through-conduit gate valves, in working pressures from 1,000 to 15,000 pounds.

acf lubricated plug valves, of steel, semi-steel, and special metals, with round or rectangular ports, in working pressures from 200 to 500 pounds — are the perfect companion valves for gathering lines, manifolds, headers, and similar low pressure installations.

Because you need the finest in service wherever valves are required, you will be way ahead when you specify W-K-M or acf valves for their respective applications.

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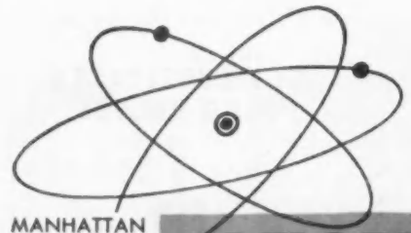

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PERFECT SEAL UNIONS
HAVE HAD A PART IN
EVERY APPLICATION OF

ATOMIC POWER

Photo courtesy of General Dynamics Corp.

LAUNCHING THE U.S.S. SEAWOLF at Groton, Conn., marked the development of the second atomic powered submarine built for the U.S. Government. Catawissa Valve & Fittings Co. is proud of its role in the project as major suppliers of Forged Steel Pipe Unions for the "Seawolf" — another repeat order in the atomic field . . . proof positive of satisfactory service!

SAFETY IS A "MUST"

From the original "Manhattan Project" to the U.S.S. Seawolf (and other unannounced atomic developments in private quarters), Catawissa Perfect Seal Pipe Unions have been specified to handle the extreme pressures involved. These are examples of "the toughest jobs", where absolute safety is a "must"!

3-TO-1 SAFETY FACTOR

One of the many extra value features of Catawissa Unions is in the very design itself — a design which gives each union a 3-to-1 safety factor. Catawissa 3000-lb. service unions, for example, are tested to 9000-lbs.; 6000-lb. service unions are tested to 18000-lbs., etc.

This point of superiority, plus expert workmanship and 40 years of experience, make Catawissa Forged Steel Pipe Unions and Swing Check Valves the best buy for rugged, trouble-free service wherever dependable performance is required.

PERFECT SEAL SEATING

Another Catawissa exclusive is its Ball-to-Angle seat design, which assures a Perfect Seal even when the two pipes joined are not in alignment.

ALL PRESSURES, TEMPERATURES

The Catawissa line is the most complete line of unions on the market—regular or special! They're hot forged from solid bars of AISI Spec. C-1026 steel, and meet the requirements of ASTM Spec. A-105, Grade 2.

YOU CAN TAKE THE GUESSWORK OUT OF PIPING PROBLEMS

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Company (New Jersey) as financial analyst in the Treasurer's department. In October, 1953, he accepted a post with the Creole Petroleum Corporation in Caracas, Venezuela, as head of the financial section, Treasury department, where he remained until his recent transfer to International.

Otis Goode

Leo Dean

Llano Drilling Company of Midland, Texas, announced that **Leo Dean** has been transferred to Morgan City, La., as drilling superintendent, Gulf Coast district. He will be in charge of Llano's offshore operations, including the drilling tender Clayton G. Dorn. **Otis Goode** of Odessa, Texas, has been promoted to drilling superintendent, West Texas-New Mexico district, the position formerly occupied by Dean, and will have charge of the firm's five rotary rigs in the Permian Basin.

•

The Texas Company has announced the appointment of **R. E. Wright** as staff petroleum engineer in the Domestic Producing department. He has been petroleum engineer in the general manager's office at Houston since 1955. Wright joined Texaco in 1946 as a roustabout in Texas. He served in various engineering positions, and in 1953 was named assistant division petroleum engineer of the South Texas division.

•

George O. Relf, Jr., has been named exploration manager for the Houston Production division of **Gulf Oil Corporation.** Relf succeeds **George B. Lamb,** who died September 20. Relf joined Gulf's Venezuelan subsidiary, Mene Grande Oil Company, in 1937, as a geologist. In 1951 he was promoted to assistant chief geologist for Mene Grande, and in 1955 he was transferred to Houston as division chief geologist for the Houston Production division of Gulf, which position he has held up to the present time.

George O. Relf, Jr.

•

The Texas Company named **John W. Green** manager of the Company's 11-state Southern region. Green, manager of Texaco's Houston Sales division since 1953, succeeds **C. N. Brooks,** who has been promoted to general manager, Foreign Operations department, Eastern Hemisphere. It was also announced that **D. B. Monroe** has been appointed manager of the Houston division, succeeding Green.

Monroe has been assistant division manager since 1953. Green joined Texaco's

Harold G. Mangelsdorf has been named the first full-time chairman of the Ad

been with Esso Standard since 1934 when

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Ultra Fine Diamond Equipment for the Oilfield

Monroe has been assistant division manager since 1953. Green joined Texaco's Sales department in 1935. He worked in various selling capacities in Texas from 1935 to 1942, when he became state sales manager for Georgia. From 1948 he served as an assistant division manager in Atlanta division and later in Houston division, until 1953, when he was appointed manager of Houston division. Monroe has been employed by Texaco since 1933. Following Sales department assignments in many parts of Texas, he was assistant division manager, (Sales Promotion), Atlanta division, from 1949 to 1952, when he returned to Houston as assistant territorial manager (Sales Promotion). A year later he was appointed assistant manager of Houston division.

Harold G. Mangelsdorf has been named the first full-time chairman of the Advisory committee on human relations of **Esso Standard Oil Company.** Esso will intensify its studies of human relations and the growing importance of such studies to industrial organizations. Employe, government, and public relations data will be coordinated with Medical department information to aid human relations studies. Mangelsdorf has been with Esso Standard since 1934 when he joined the engineering staff of the Baton Rouge refinery.

H. G. Mangelsdorf

•

Dr. Paul D. Torrey, petroleum engineer and geologist, president of **Orchem Corporation,** Austin, Texas, has been appointed lecturer in petroleum engineering at The University of Texas. Dr. Torrey is an authority on secondary recovery. In 1950 he received the Certificate of Appreciation of the American Petroleum Institute for meritorious service to the petroleum industry for "outstanding achievement" in the promotion of studies and publications on secondary recovery of oil, which brought forth two editions of the distinguished work "Secondary Recovery of Oil in the United States." He has been chairman of district committees, head of the Program committee of the Division of Production, and the chairman of the Central committee on Drilling and Production Practice in API. He also served with the Interstate Oil Compact Commission as chairman of its Secondary Recovery and Pressure Maintenance committee.

Dr. P. D. Torrey

•

The Texas Company announced the appointment of **Harvey Cash** as assistant to the chairman of the board of directors, **Augustus C. Long** of Texaco's Foreign Operations department—Eastern Hemisphere. Cash joined Texaco in 1933. He has been supervisor of field operations, Geophysical division, at Houston. He held positions as petroleum engineer and assistant division manager in the Producing department prior to being transferred to Foreign Operations in New York in 1953.

•

Everett L. Vilander was named as public relations representative for the **Shell Oil Company** Exploration and Production area covering several mid- and southwestern states. Vilander will replace **Wm. Reed Hoyt,** who has resigned to join the public relations staff of Kaiser Industries Corporation on the Pacific Coast. Vilander comes to Tulsa from New Orleans where he has been a Shell public relations representative during the past two years.

Everett L. Vilander

•

T. M. Kerr, formerly executive vice president of **Kerr-McGee Oil Industries, Inc.,** has been elected vice chairman of the board of directors. Other elections to high-level positions within the company also were announced. **F. C. Love,** formerly general vice president, will become executive vice president. **A. T. F. Seale,** for-

This rugged new engine has been added to the Wisconsin line to fill the horsepower gap between the Model VF4 25 hp. and the Model VG4D 36 hp. Wisconsin Engines. At the same time, the mounting base is dimensionally identical to the Models VE4 and VF4 to permit convenient replacement of the latter engines if greater power is required.

The Model VH4, which now makes its bow for the first time, is the most powerful engine of its type and size available today, in our estimation. It is an engine of basic High Torque design which gives it the important advantage of being able to deliver maximum usable *Lugging Power* that carries the load through the hard, heavy pulls. It has been designed to give you the best possible performance at all engine speeds from 1400 to 2800 rpm., even when operating under intermittent shock-loads or under constant load, continuous service.

The Model VH4 is a heavy-duty engine in all respects, built for hard service under all operating conditions, at temperatures from sub-zero to 140° F. (60° C.). It is an exceptionally smooth-running, even-firing engine and has all the traditional heavy-duty features that characterize *all* Wisconsin Models, from 3 to 36 hp. It can be supplied as an "open engine" with side-mount fuel tank, or as housed power unit and may be equipped with electric generator and starter (or starter only), clutch, reduction or clutch-reduction assemblies . . . and is adaptable to operation on a variety of fuels such as gasoline, kerosene, natural gas, Butane, Propane or fuel oil of 35 Octane rating or better.

Learn more about this new engine. Write for Bulletin S-196 for detailed data and engineering specifications.

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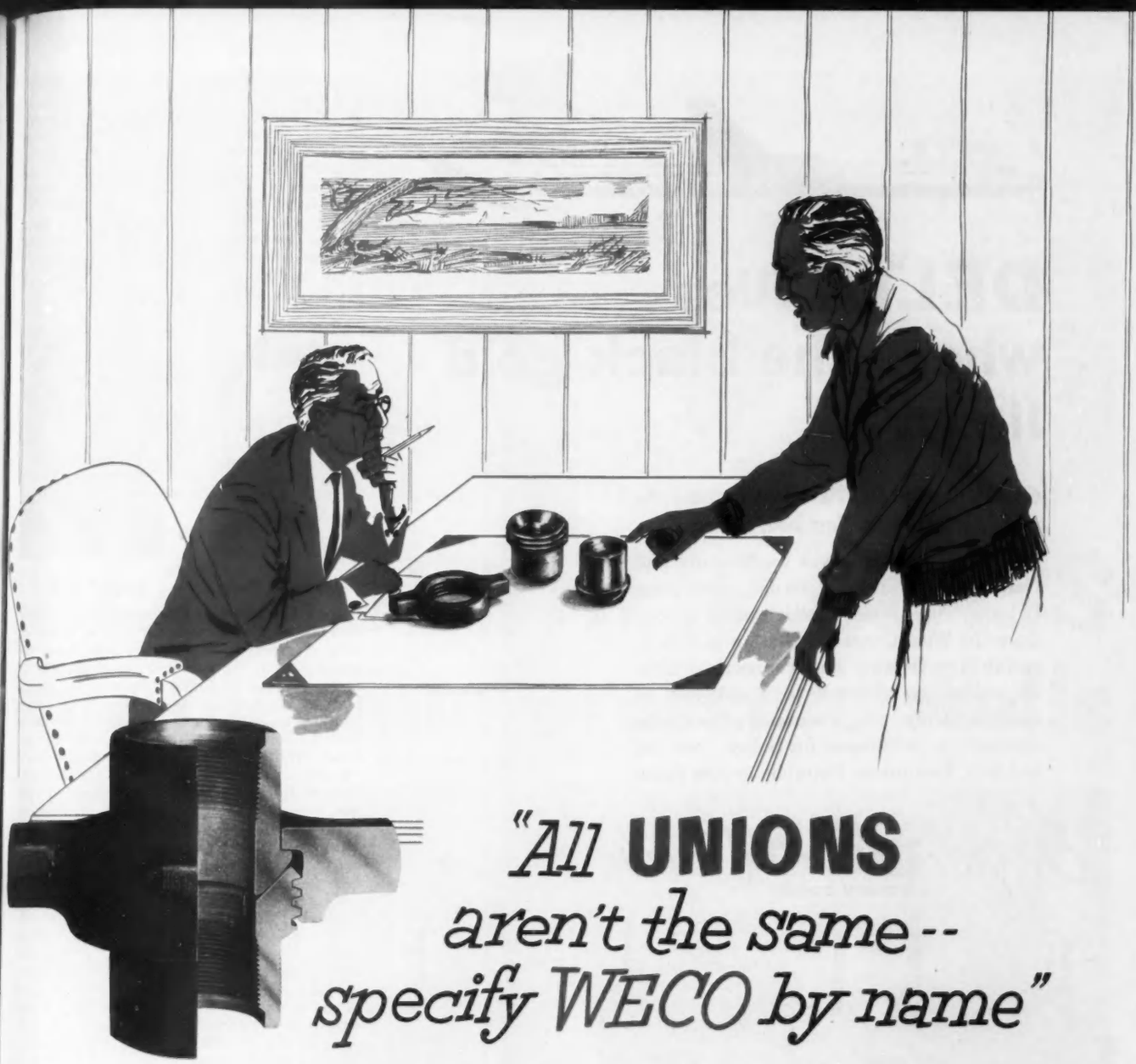

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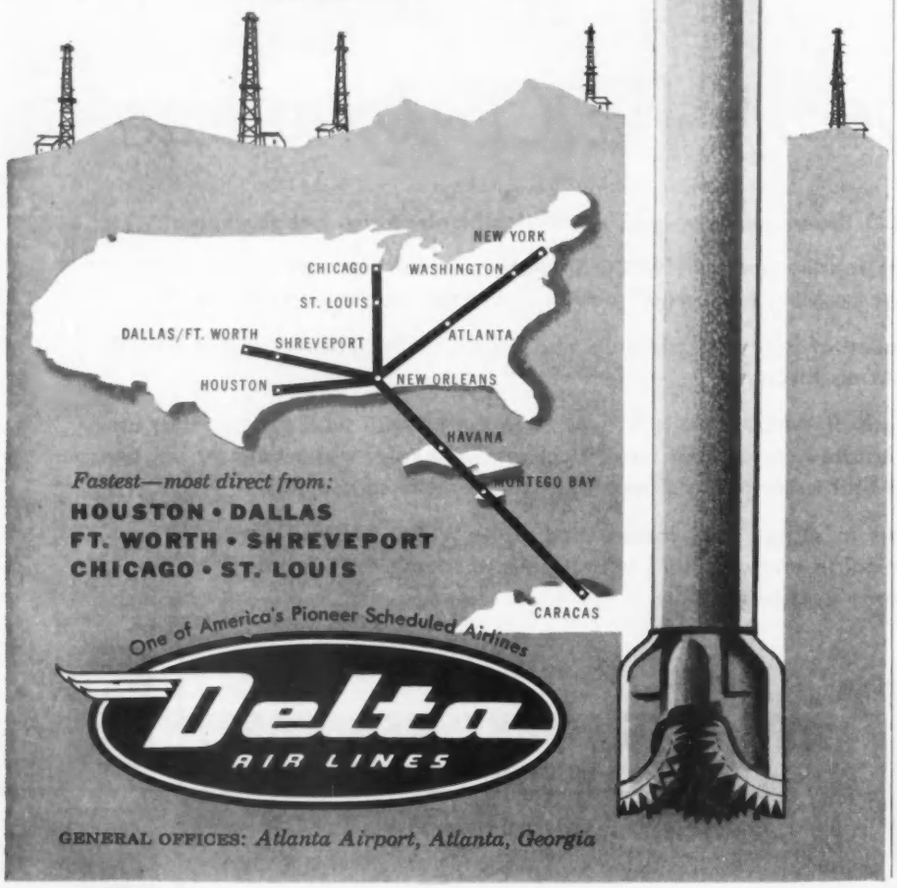
Royal DC-7 *Caribe*
GOLDEN CROWN



GENERAL OFFICES: *Atlanta Airport, Atlanta, Georgia*

merly vice president of manufacturing, will become vice president of operations. **W. M. Murray** has been named vice president of general sales, **R. M. Chesney** vice president of refining, and **J. W. Roach** vice president of crude oil supply, pipe lines and refinery technical services. The three were vice presidents of Deep Rock Oil Company before its absorption as a division of Kerr-McGee. **G. B. Parks**, formerly manager of production and drilling operations, has been elected vice president of production and drilling operations.

William M. Parks

Wilford B. Kirk

Nortex Oil and Gas Corporation of Dallas announced a change in the board of directors of Nortex. The Board has been increased from the previous five members to seven. **Arnold H. Bruner**, formerly a member of the board, resigned due to pressing business and three new directors have been added. New board members elected include **William M. Parks**, presently vice president and general counsel for Nortex, and **Wilford B. Kirk**, while **Ron Stever** was elected to serve in place of Bruner. Stever is president of Ron Stever & Company, consulting firm of Los Angeles. He is also a trustee of Scripps College of Claremont, Calif., a trustee of Boy's Republic of Chino, Calif. In addition to these positions, Stever is a member of the advisory board of Western Bank & Trust Company of Pasadena, Calif., a director of Citizens National Trust & Savings Bank of Los Angeles, a director of the Los Angeles chapter of American Red Cross and past president of the alumni association of the University of Southern California. Kirk presently is associated with Texas Bank & Trust Company of Dallas as vice president. He is also a member of the University Club of New York, president of the Harvard Advanced Management Association of Dallas and Fort Worth and is active in various civic affairs. These new directors will continue to serve in the capacities as outlined in addition to their duties as directors of Nortex.

●

Donald Henry has been appointed secretary of the **International Petroleum Company, Ltd.** Since joining International Petroleum in 1953, he has been International's advisor on organization planning and management development. He served with the Office of Housing Expeditor, Washington, as special assistant on management matters. From 1947 to 1949 he served as personnel director of The Washington Post. Henry was with a management consulting firm from 1949 to 1953, working primarily with oil companies in South America, Europe and the Middle East.

●

Maxwell W. Balfour, W. K. Bullock and **Barnabas B. Hadfield** were elected to the board of directors of **Skelly Oil Co.**, succeeding **Emil Kluth, S. E. Cavanaugh** and **C. C. Herndon**, former executive vice president, retired.

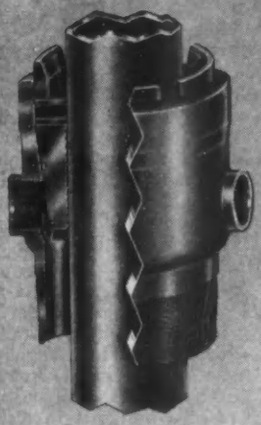
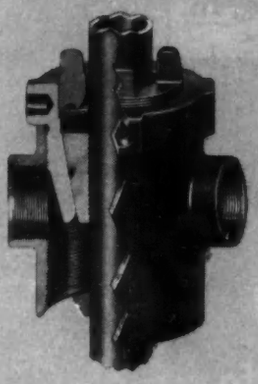


FIG. 91

Simplicity and compactness, for ease of installation and neatness of hook-up, are incorporated into the Larkin Casing Head (2000 psi test, 1000 psi working pressure.) It is designed to provide a safe and economical means of suspending and packing off casing strings. This head has been tested to support 225,000 lbs., equivalent to 5600' of 7", 20-lb. casing with a safety factor of 2.



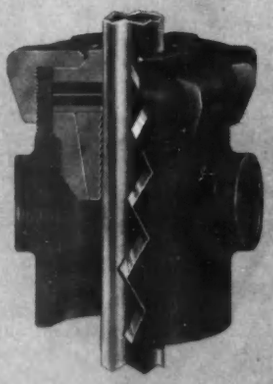
TYPE L

A new member of the Larkin Well Head line, the Type L Tubing Head fills a need in low pressure areas where economy may be effected with complete safety. It is forged steel construction, full opening, 2000 lb. psi, top of body threaded 7" API to accommodate control equipment, hinged three-segment slips, 2" or 3" side outlets.

HEAD OF THEIR CLASS
for medium pressure wells

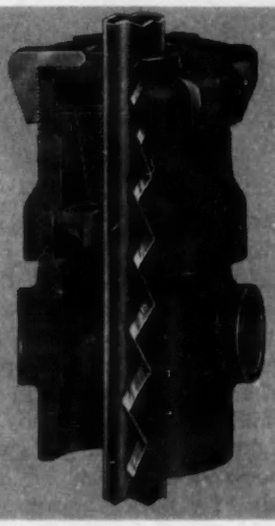
TYPE R

The Larkin Type R. Tubing Head is a conversion from the Type SR Head. This ease of conversion makes it possible to use the same stripper adapter and Neoprene stripper when working on any well equipped with a Larkin Tubing Head.



TYPE SR

The Larkin Type SR Tubing Head is a slip suspension head, equipped with a Neoprene Stripper which serves as a blow-out preventer and oil saver while tubing is being pulled or run. It is very suitable where higher pressures might be encountered.



For detailed information on these and other Larkin Tubing and Casing Heads, please refer to your Larkin Catalog or talk to your Larkin Representative. All Larkin Equipment is available through your supply store.

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Use SAFETY GRIP-STRUT grating

Wherever a safe footing is required

Grip-Strut circular stairway on Shell Oil tank in Portland, Ore.

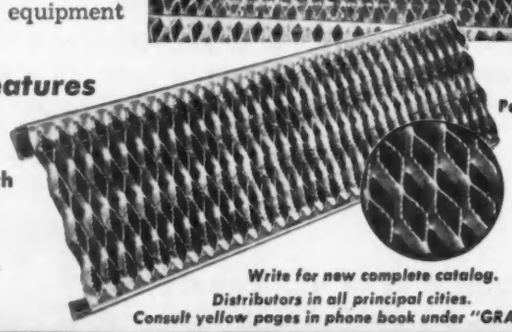
See how Shell Oil uses Grip-Strut for a safe ramp between tanks.

View looking down circular stairway on Shell Oil tank shown above.

SAFETY GRIP-STRUT is the new basic material, all in one piece (including channels), not welded, riveted or expanded in steel or aluminum, in standard sizes and gauges. Safety GRIP-STRUT presents an open space, in a diamond pattern, in excess of 55% of the area for ready access of light and air and gives a positive NON-SKID footing in all directions. Ideal for work platforms, stair and ladder steps, flooring, balconies, catwalks, machinery guards, fire escapes and for original equipment safety treads.

Important Safety Features

- ★ Fire proof
- ★ Slip proof
- ★ Maximum strength
- ★ Minimum weight
- ★ Easy to stand on
- ★ Cool in summer—warm in winter



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DEATHS

Albert E. Collins, died September 9, at a Monterey Park, Calif., hospital. He started a 42-year career with Shell Oil Company in 1912 at Coalinga, Calif. He retired in 1954, as purchasing and store manager for Shell's Pacific Coast area. After retiring from Shell, he was associated with the Haldeman Pipe and Supply Company, Los Angeles.

Rowland G. (Peg) Whealton, for many years an oil man in California and since the war a consultant in Los Angeles died in a Pasadena, Calif., hospital, August 25. He began his career in the oil business as an employe of oil companies in Kern and Los Angeles counties. During the war he was on the District 5 staff of the Petroleum Administration for War, first as assistant director of production and finally as district director.

Anthony S. Stadler, 63, senior buyer for the Jones and Laughlin Steel Corporation at Tulsa, died September 1 from injuries sustained in an automobile accident near Rolla, Mo.

Frank M. Larkin, 79, independent Tulsa oil operator, died September 5. He headed Larkin-Graham Oil Company and Ell-Mar Oil Company.

Robert H. Searcy, pioneer Tulsa, Okla., independent oil operator and founder of Robert H. Searcy and Sons, died August 25.

Col. E. B. LaRue, died at his home in Athens, Texas, October 17. He had drilled more than 100 exploratory wells from 1930 to the time of his illness in 1956 and had the record of drilling more wildcat wells during the depression years than anyone else. He pioneered the LaRue Dome in Henderson County, Texas, in 1928, discovered the Huntington, Texas, oil field, and the marine basin on the Atlantic Coast.

Eugene T. Singer, 69, a former vice president and director of Standard-Vacuum Oil Company, died in St. Petersburg, Fla., recently. Singer began his career in 1912 and served many Far East posts for Stanvac through the years. He played a leading part in the company's post World War II refinery rehabilitation in the Orient.

O. W. Corrie, 44, a member of the Public Relations department of Standard Oil Company (New Jersey) since 1948, died April 4.

Singer B. Irelan, director of Cities Service Company and president and director of Cities Service Oil Company (Del.), died in a New York City hospital during the summer. He had been with Cities Service since 1909.

Frank W. Sutton, 81, co-owner of the Sutton Manufacturing Co., of Tulsa, Okla., designer and manufacturer of oil field and pipe line equipment, died September 28.

Al W. Hamill, 80, driller of the Lucas gusher at Spindletop, on the outskirts of Beaumont, Texas, which opened a new era in the petroleum industry, died at his home in Tulsa September 29.

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What's Happening

AMONG INDUSTRY ASSOCIATIONS

Jake Hamon

Frank Porter

D. L. Connelly

D. T. Colley

H. W. Ferguson

F. O. Prior

B. B. Jennings

Lacey Walker

API Renames Hamon, Porter; Connelly Named Production VP

At the annual American Petroleum Institute meeting in Chicago last November 12 through 15, Jake L. Hamon was re-elected chairman of the board and Frank M. Porter was re-elected president.

Hamon is an independent producer while Porter is a drilling contractor and head of Fain-Porter Drilling Company.

Other officers elected or re-elected at the Board of Director's meeting in the Conrad Hilton are as follows:

D. L. Connelly, senior vice president and a director of Warren Petroleum Corporation, Houston, was elected vice president for production.

Dwight T. Colley, vice president and general manager of marketing, Atlantic Refining Company, Philadelphia, was elected vice president for marketing.

H. W. Ferguson, vice president, Humble Oil & Refining Company, Houston, was elected vice president for refining.

Frank O. Prior, president of Standard Oil Company (Indiana), Chicago, was re-elected vice president for transportation.

B. B. Jennings, chairman of the board of Socony Mobil Oil Company, New York, was re-elected treasurer.

Lacey Walker, API, New York, was re-elected secretary.

H. H. Stewart, API, New York, was elected assistant secretary.

Connelly, director and senior vice president, Oil Production division, Warren Petroleum Corporation, moved to the rapidly expanding Mid-Continent oil producing area after World War I. He became a scout and landman for Gulf Oil Corporation, serving them between 1922 and 1926. He then became an independent oil operator at Cisco, Texas, for two years before joining the former Indian Territory Illuminating Oil Company of Bartlesville, Okla., in 1928, as a landman, eventually being advanced to manager of the Land and Geological division.

Connelly was transferred to Houston as manager of the Texas Land and Geological division of Cities Service Oil Company in 1941, and resigned in 1944 to head the newly-created oil production activities of Warren Petroleum.

His memberships include API, Independent Petroleum Association of America and Texas Mid-Continent Oil & Gas Association, of which he is also a director.

34 Oil Men Receive Awards of Appreciation

Certificates of appreciation were presented to 34 oil men at the thirty-sixth annual meeting of the American Petroleum Institute in Chicago last November. The certificates are given annually to those oil men who, by long service or other activities, have contributed materially to the industry and the Institute.

Recipients of the API honors this year were as follows: Roy B. Glass, Socony Mobil Oil Co.; D. R. McCallum, Sinclair Refining Company; Robert A. Douglass, Ethyl Corporation; Arthur J. De Blois, De Blois Oil Co.; Conger Reynolds, retired, Standard Oil Company (Indiana); and Phillips C. Salmon, Socony Mobil.

G. M. Knebel, Standard (New Jersey); Robert E. Wilson, Standard (Indiana); Wheeler G. Lovell, Ethyl; Paul J. Bond, The Pure Oil Company; Ralph R. Clagett, (posthumous); Pure Transportation Company; Millard Gobert Gamble, Esso Shipping Co.; George H. Hill, Jr., Cities Service Company; Charles S. Jones, Richfield Oil Corporation; William Bradford Jupp, Socony Mobil; John L. Shoemaker, Service Pipe Line Company; Robert James Walshe, The Texas Company; Robert J. Whiteley, Socony Mobil; and Ralph D. Wyckoff, Gulf Research & Development Company.

Also C. E. Beecher, Cities Service; W. O. Clindedinst, National Tube Division, U. S. Steel Corporation; Everett P. Hayes, California Texas Corporation; W. F. Herbert, Texaco; S. S. Parker, J. C. Slonneger, Continental Supply Company; W. V. Vietti, Texaco; John Woodruff, The University of Texas; and David C. Proctor, Gulf Oil Corporation.

Dwight T. Colley, The Atlantic Refining Company; J. G. Jordan, Shell Oil Company; Frank R. Markley, Sun Oil Company; C. D. Norris, Texaco; Morgan J. Davis, Humble Oil & Refining Company; and O. D. Stallard, Jr., Magnolia Pipe Line Company.

J. Frank Drake Receives API Gold Medal Award

The API's Gold Medal For Distinguished Achievement was awarded to J. Frank Drake, former president and retired chairman of the board of Gulf Oil Corporation.

J. Frank Drake

Drake was elected chairman of the board of Gulf in May, 1948, and five years later was named chairman of the Executive committee.

During his career in petroleum, Drake has been a member of the board of the API, and has served with the Petroleum Industry War Council, and the National Petroleum Council and the National Industrial Conference Board, of which he was chairman from 1945 to 1947.

Exploration Geophysicists Pick 5 for Convention

Five appointments for the 1957 national convention of the Society of Exploration Geophysicists, to be held at The Statler Hilton Hotel in Dallas, were announced.

E. O. Vetter will be assistant general chairman and chairman of the Finance committee. Vetter is administrative vice president of Geophysical Service, Inc. in Dallas.

Glen M. Conklin will be chairman of the Technical Program committee. This committee will be charged with the responsibility of scheduling technical papers for the convention which deal with the recent developments in petroleum exploration that are of prime interest to the visiting geophysicists. Conklin is Seismograph section head, Southwestern division, Sun Oil Company in Dallas.

John Cathey, chief geophysicist for Seaboard Oil Company, Dallas, will be chairman of the Exhibits committee. M. C. Kelsey will be the chairman of the Entertainment committee. Kelsey is president of the Rayflex Exploration Company in Dallas.

The Housing committee will be headed by O. C. Clifford, Jr., who is chief geophysicist of The Atlantic Refining Company in Dallas.

Oil and Gas Law School Given in January at Dallas

Oil and Gas Law will be the theme of the two events scheduled during January at the Southwestern Legal Center, Dallas. A short course on Oil and Gas Law will be offered January 3-29, 1957, and the Eighth Annual Institute on the Law of Oil and Gas and Taxation has been scheduled January 30 through February 1.

Both events are sponsored by the Southwestern Legal Foundation in cooperation with the Southern Methodist University School of Law.

The special short course is designed for those lawyers who have had little or no experience in oil and gas law, yet is of sufficient content to accord an ideal refresher to the more experienced attorney, according to Gordon R. Carpenter, executive director of the Southwestern Legal Foundation.

Open to practicing attorneys who are members in good standing of their State Bars, the course will be instructed by SMU Law Professor Wilmer D. Masterson, Jr., widely known lecturer and author in the field of oil and gas law.

New Orleans Geologists Elect Harvey President

The New Orleans Geological Society has elected the following officers for the year 1956-57. Lyle Harvey, John W. Mecom interests, is the new president. Vice president is D. D. Wingfield of Monterey Oil Company.

C. S. Killgore of Continental Oil Company is the new secretary, and R. M. Jemison of Freeport Sulphur is the treasurer.

Canadian Petroleum Elects 13 Directors

At the annual meeting of the Alberta division of the Canadian Petroleum Association held in Calgary last October, 13 directors were elected to the 25-man board.

Elected for a one-year term was G. L. McMahon of Pacific Petroleums Limited. Elected to hold office during a two-year period were the following: E. C. Babson, Union Oil Company of California; A. E. Feldmeyer, Canadian Superior Oil of California Ltd.; J. P. Gallagher, Dome Exploration (Western) Ltd.; G. H. Galloway, Stanolind Oil & Gas Co.; W. H. Hohag, Banff Oils Ltd.; Dr. W. C. Howells, McColl-Frontenac Oil Co. Ltd.; C. A. Nabors, Parker Drilling Co. of Canada Ltd.; N. W. Nichols, Great Plains Development Co. of Canada Ltd.; T. Nitescu, Canadian Fina Oil Ltd.; J. G. Spratt, Triad Oil Co. Ltd.; S. Stewart, Richfield Oil Corporation; and J. B. Webb, Canadian Oil Companies Ltd.

AAODC Chooses Kirberger As Tulsa Chapter Chairman

Earl Kirberger, Service Drilling Co., Tulsa, has been elected chairman of the Tulsa chapter, American Association of Drilling Contractors, succeeding T. W. Wheeler, Loffland Brothers Company. Other new officers are Sam Brown of Helmerich and Payne, Inc., vice chairman; Jim Frawley of Frawley Drilling Co., secretary; and Loyd F. Worley of Worley & Harrell, Inc., treasurer.

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Companies in the News

Nortex Receives Oscar

Nortex Oil and Gas Corporation of Dallas was awarded the Bronze Oscar for best annual report advertisement of the petroleum industry. More than 1400 industrial executives from all over the U. S. and Canada attended the "Financial World" awards banquet at the Hotel Statler in New York last October to witness the "Oscar of Industry" awards for the best annual report advertising of 1956. Admiring the award during the presentation ceremonies for Nortex are (left to right) William G. Proctor, secretary-treasurer; James R. Wendover, president, and R. A. Pitt, vice president of Ted Workman Advertising.

GENERAL PETROLEUM CORPORATION'S coring ship, the M. V. Torry, is now taking samples off the Southern California coast. The Torry has several unique features. She is the first freighter-type, self-propelled vessel which drills through the center. In the drilling operation the casing is set and a blowout preventer used with a complete circulation system. Salt water, salt water mud or fresh water mud can be utilized. The Torry is not a barge. She is a motor vessel, easily maneuverable. She is adapted for exploratory coring over extended areas in waters exposed to ocean swells and storms. Another Torry innovation is the method of racking pipe. To increase stability, and because of space limitations, the pipe is racked horizontally on a specially designed platform amidships. Sections are hoisted and racked through the use of a unique conveyor belt which traverses the entire length of the walk. A hydraulic lift raises and lowers the pipe while in a racked position to take full advantage of available storage space.

Drilling from a floating platform presents many problems. The natural roll of the ship would make drilling in a vertical position difficult without specially designed equipment to compensate for it. This problem has been solved through the use of an ingenious counterbalance system. The rotary table is of a gimbal type which helps compensate for the ship's movement and maintains a uniform rate of rotation on the drilling string. A special "guide elevator" keeps the string in a vertical position under water. The bottom part of this system is called a depth spider and guides the bit into position when drilling starts, and back into the hole after changing the bit. Another principal feature of the Torry is the precision radar which is used for positioning the vessel over the coring site. Geologists have a small laboratory aboard to analyze cores.

•

STANDARD OIL COMPANY OF TEXAS announced plans to award unrestricted grants to the University of Houston and the University of Tulsa during 1957 supplementing the scholarships and fellowships already included in its general program of aid to education. Standard's grants are part of the over-all educational program of its parent Company (Standard of California) involving $1 million. Included in this program are 11 fundamental research projects at eight universities, 52 technical fellowships and 234 undergraduate scholarships at some 100 colleges.

•

SAHARA PETROLEUM COMPANY, a subsidiary of **CONTINENTAL OIL COMPANY** operating in Egypt, transferred its domestic offices from Ponca City, Okla., to New York City. The New York offices of Sahara are in the Standard Brands building. The company's headquarters offices are in Alexandria, Egypt. Sahara officials in the New York office are **Donald W. McGee,** assistant to the general manager; **J. F. Breen,** purchasing agent; **S. H. Rider,** personnel manager; **K. H. White,** traffic manager; and **J. L. O'Neil,** accountant.

•

THOMAS AND BREWER COMPANY has been formed by **George W. Brewer, Jr.,** and **Glenn F. Thomas** recently. Brewer resigned as district landman and Thomas resigned as district geologist from Lion Oil Company's Liberal, Kansas, district to head the new company. They will headquarter in Liberal, Kansas, with operations covering portions of Colorado, Kansas, Oklahoma and Texas.

•

CONTINENTAL OIL COMPANY'S annual report to stockholders for 1955 has been judged as the best report among integrated petroleum companies for the fourth consecutive year. The ratings were made by an independent board of judges in the 16th annual survey sponsored by "Financial World," national weekly magazine. The bronze "Oscar of Industry" was presented to L. F. McCollum for Conoco at the annual awards banquet in the grand ballroom of the Hotel Statler in New York on October 29. A total of 5000 annual reports were considered this year in the international competition, and 1700 qualified for the final screening. These were judged in 100 industrial classifications for bronze trophies. In the integrated oil company classification, CREOLE PETROLEUM CORPORATION was runner-up for top honors, while STANDARD OIL COMPANY (OHIO) placed third.

•

THE CREOLE PETROLEUM CORPORATION has decided to establish a Foundation to support and encourage cultural, educational and scientific activities in Venezuela. The Foundation, which is being established as a separate legal corporation with its own staff and board of directors, will be in operation before the end of 1956. Creole is prepared to provide it with a substantial operating budget during its first year of operation, as well as provide financially for its future activities on a long-term basis. **H. W. Haight,** president of the company, said that the objectives of the new Foundation will be similar to those of other organizations now carrying out such work in Venezuela under the sponsorship of private industry, individuals, or civic groups. Its programs might eventually include specific aid for education at various levels, scholarships and fellowships, student-teacher exchanges; scientific research; training in such fields as art, music, literature and medicine and nursing; the further development of agricultural training and research; youth training and organized recreational programs; the establishment of prizes and awards and other related activities designed to stimulate the arts and sciences. Haight emphasized that the Foundation will utilize the intellectual resources of Venezuela in the development of its program. In this connection, its staff will seek the services of competent Venezuelan consultants from the educational, scientific and cultural spheres throughout the country.

•

TIDE WATER ASSOCIATED OIL COMPANY has officially changed and shortened its name to Tidewater Oil Company. However, the "Flying A" will be continued as one of the trademarks for the company's products.

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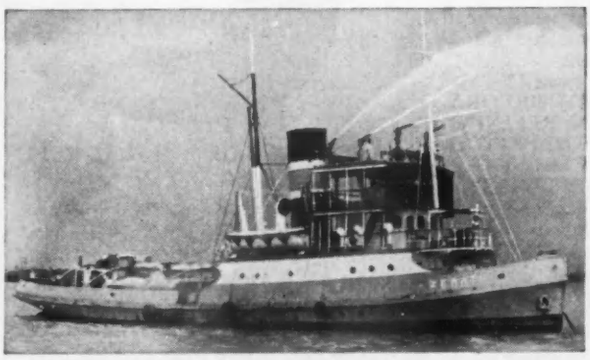

Merryweather Fire Fighting Equipment in Indian Ocean

V.R.180 Tractor in Tasmania

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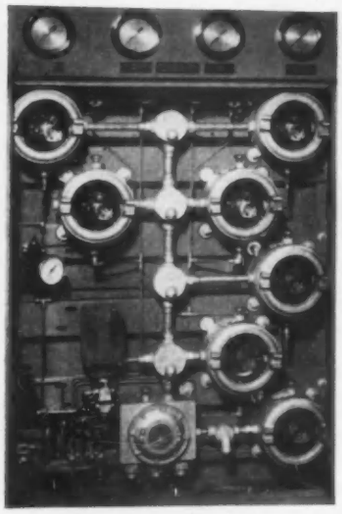

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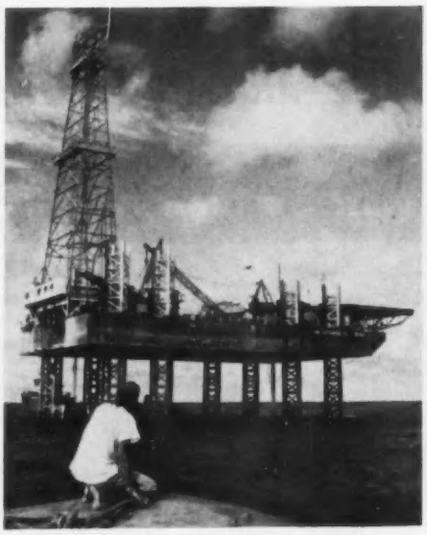

The Shell-Humble OCS 0443 No. 4 discovery well.

SHELL OIL COMPANY announced a new offshore oil discovery in Block 188. The Shell-Humble OCS 0443 No. 4 discovery well is located approximately 70 miles south of Morgan City in Gulf waters 67 feet deep known as the Eugene Island area. On a drill stem test, the well produced at a daily rate of 378 barrels of 35.9 gravity oil with 182,000 cubic feet of gas and no water. **B. Dykstra,** Shell vice president in New Orleans, said. The test was made through a 9/64-inch choke from the interval of 10,497 to 10,511 feet, and tubing pressure of 2025 pounds per square inch. After two previous dry holes were drilled jointly by Shell and Humble in Block 188 and abandoned in salt at depths of 4050 and 5529 feet, the discovery well was spudded in August 21 by Offshore Company's rig No. 54. The well was drilled to a total depth of 11,691 feet. The company's nearest production is 20 miles northwest in Block 128 field where Shell and Union Producing Company jointly drilled several successful wells.

•

COSDEN PETROLEUM CORPORATION will buy **COL-TEX REFINING COMPANY** from **ANDERSON-PRITCHARD OIL CORPORATION** and **STANDARD OIL COMPANY OF TEXAS** for 350,000 shares of Cosden common stock, which currently would be valued at $7.65 million. Col-Tex operates a 12,000 barrels per day refinery at Colorado City, Texas, and a gathering system. Col-Tex will become a wholly-owned subsidiary of Cosden.

•

GARVEY DRILLING COMPANY announced the opening of a new office at 405 Cravens building, Oklahoma City. **Neal Colby,** contact representative, will be in charge. He has been transferred from the Great Bend, Kansas, office. The opening of the new office is in line with their recent expansion program. They are currently operating two large rigs in Garfield County and Texas County, Oklahoma.

•

CHRISTIANA OIL COMPANY of Beverly Hills, Calif., and the **CAPITAL COMPANY** recently bought the Diamond Bar Ranch, said to be the largest remaining parcel of undeveloped land in Los Angeles County. The two companies also made a purchase from **BARTHOLOMAE CORPORATION** of 33 producing oil wells in East Coyote and Long Beach fields.

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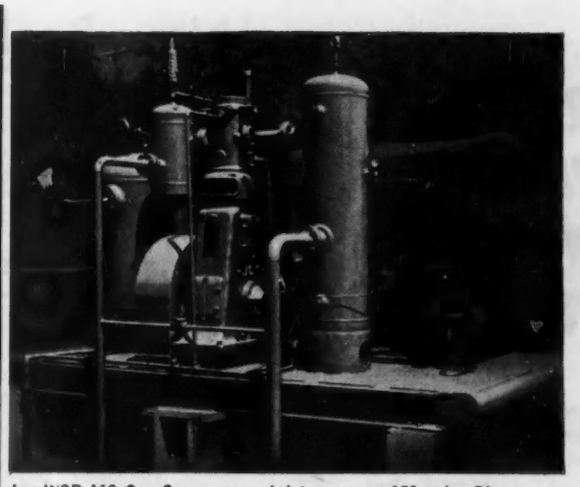

Joy WGB-110 Gas Compressor. Inlet pressure 150 psig; Discharge pressure 500 psig. Capacity 1.028 MMCFD. "Packaged" by McNamar Boiler & Tank Co., Tulsa.

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Modern Joy Packaged Gas Compressors are backed by a century-old reputation for low maintenance and long service. These *time-proved* features make Joy Compressors the most reliable for gas gathering, repressuring, or gas lifting:

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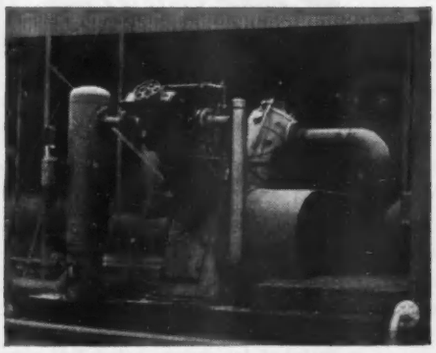
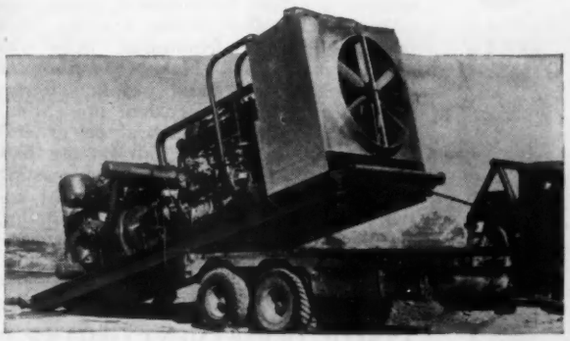
Joy Gas Compressors are available in space-saving vertical, V-type, and semi-radial designs . . . single or two-stage units with cylinder sizes from 3″ to 13½″. Four different frame types accommodate a power range of 50 to 400 HP.

For the most efficient compressor for your needs, consult a Joy Engineer or write to ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*



Joy WNB-112 Gas Compressor. Inlet pressure 35 psia; Discharge pressure 665 psia. Capacity .85 MMCFD. "Packaged" by Oil & Gas Supply Company, Houston.



This photo of a Joy WNB-114 Gas Compressor Package being unloaded onto concrete pad clearly illustrates portability of unit. Inlet pressure is 5 psig; Discharge pressure is 150 psig. Capacity 2 MMCFD. "Packaged" by McNamar Boiler & Tank Co., Tulsa.

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AIME DIRECTORY, Gulf Coast Section, 3801 Cullen Blvd., Houston 4.

The Gulf Coast Section AIME directory is furnished gratis to members but a limited number of copies of the personnel listing is available at $1 per copy.

•

FORMATION EVALUATION SYMPOSIUM COMPILATION, Humble Oil & Refining Company, P. O. Box 2180, Houston, $5.

The original 2000 copies of the compilation has been exhausted and 500 more have been printed. Contact H. M. Krause at Humble for copies.

•

NATIONAL DIRECTORY OF SAFETY FILMS, The National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

The 1956 directory provides a compact source of information on films on safety, first aid, fire prevention and civil defense. It describes more than 1200 films that are available without restriction on distribution. Information includes millimeter, running time, color, year of production and a brief summary of the plot. Among the subjects covered are industrial, commercial transport, traffic, home, farm and education.

Many of the films are cleared for television and some for theatrical distribution. Each film is available for purchase, rental, loan or long-term lease from one or more of 292 distributors. The directory includes a separate listing for those organizations which limit distribution to specific areas in the U. S. and Canada.

•

FIVE-MINUTE SAFETY TALKS FOR FOREMEN. The National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

Book 6, published by the National Safety Council, like the previous volumes, contains 52 talks designed to build sound attitudes on accident prevention. Especially useful to foreman and supervisors, the five-minute talks provide ready-to-use outline and text for informal safety pep talks or scheduled training sessions. This latest volume of five-minute talks was written by Roland Blake, co-author of "Industrial Safety" and well-known authority on industrial accident prevention.

The talks include material on general topics such as attitudes, lifting and first aid, as well as information on specific problems including the use of powder actuated hand tools, masonry chipping, caustic chemicals, explosive dusts, flammable liquids, drills, saws and electricity. There are two talks on off-the-job safety.

•

TRAFFIC DEPARTMENT ORGANIZATION, by John H. Frederick, Chilton Company, Chestnut & 56th Streets, Phila., 39, Penn., $6.

Stressing the growing importance of the traffic manager in industry, the author points out that transportation generally is the largest single cost item left in the area of controllable costs today. Taking 27 cents out of every sales dollar, transportation today is directly related to sales, production, research, purchasing, and other top policy corporate matters.

In this first book on the subject the author uses actual case histories from such firms as Sears, Roebuck; H. J. Heinz; National Distillers; American Chain & Cable;

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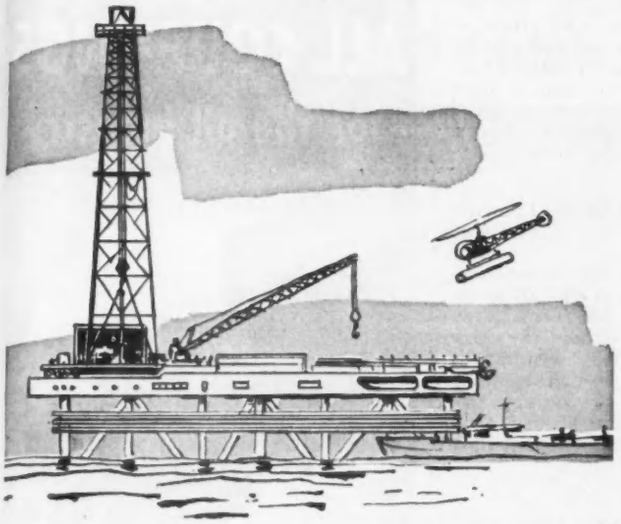

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Kaiser Aluminum & Chemical; Maytag; Koppers; Remington Rand and others to show how a new concept of traffic management has pared cost and produced savings not only in freight, but also in other areas of business. The book is published in cooperation with Distribution Age, a business paper in the traffic field.

•

THE WORLD'S TANKERS, by Laurence Dunn, John de Graff, Inc., 31 East 10th St., New York 3, $6.95.

Mr. Dunn has traced the evolution of the tanker from the days of the sail to the super-tankers of today. The book is divided into 13 sections—from The First Oil Ships on through The Twenties and Thirties, to the leading Tanker Fleets of today. Over 200 pictures are accompanied by particulars and a concise history of the vessel concerned. The author himself illustrated the book.

•

MISSISSIPPIAN ROCKS AND OILFIELDS IN SOUTHEASTERN SASKATCHEWAN, Department of Mineral Resources, Government of Saskatchewan, Bureau of Publications, Legislative Annex, Regina, Sask., Canada, $2.

The report covers approximately 30,000 square miles of territory and was the result of one year's preparation by J. G. C. M. Fuller, senior research geologist with the Petroleum and Natural Gas branch of the Department of Mineral Resources.

The discovery during 1952 of Mississippian oil near Ratcliffe in southern Saskatchewan stimulated a great expansion in drilling activity, which by the end of 1955 had resulted in the discovery of eight new oil fields and of numerous productive wildcat wells.

With this as a strong economic incentive to study the geology of the oil producing rocks, the department undertook the compilation of a report which would be of immediate use to the oil industry in general.

The 72-page report is illustrated with charts, maps and photographs in addition to the written text and tables.

•

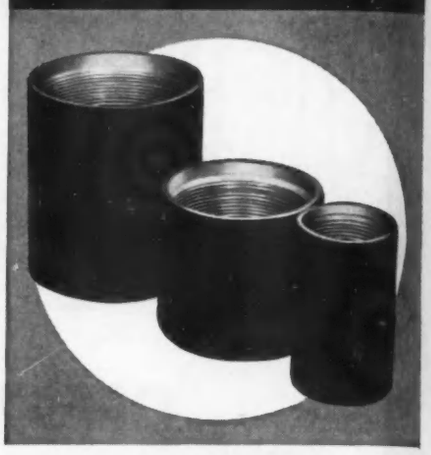
PETROLEUM REVIEW, WARD COUNTY, TEXAS, Phifer Petroleum Publications, P. O. Box 20024, Houston 25, Texas, $10.

The new reference book on West Texas oil production is the seventh in a series that includes eight counties from Yoakum and Terry on the north to the Pecos River south. Oil was first discovered in Ward County in what is now the Shipley (Queen Sand) field, November 2, 1928.

The discovery and development of 42 oil and gas fields in the intervening 28 years is outlined. Nearly 175 million barrels of oil have been produced from these fields. The major portion of the production has come from the Permian zone but as early as 1940 the Silurian was producing and at the present time there is production from the Ellenburger, Devonian, and Fusselman. Operators have maintained a steady exploration program in the county for quite some time, but the emphasis lately has been in the deeper zones.

Facts and figures for the review were compiled by Robert L. Phifer. The source of the information was the field hearing files of the Railroad Commission of Texas. Included in the 80-page book are subsurface structure maps of many of the fields and logs of discovery wells. There is also a county map with the fields outlined in color and a geological chart for West Texas.

ALL COUPLINGS for the oil industry



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Non-Upset sizes 1.900" through 4½". Upset sizes 1.660" through 4".

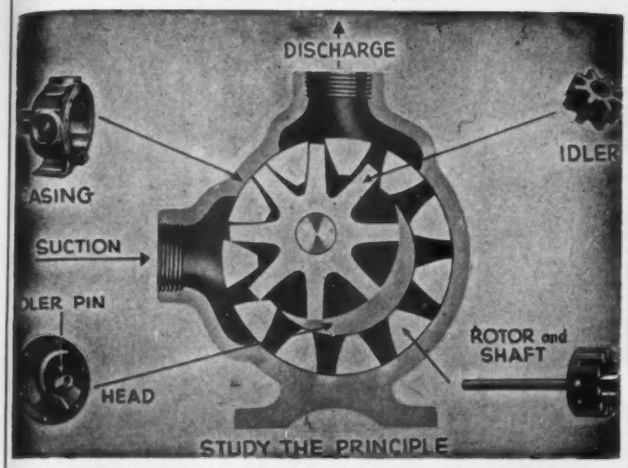
OTHER OIL INDUSTRY ITEMS

Couplings-Standard Merchant, 3000 and 6000 lb. Hydraulic and all other types of special couplings.
Hex Bushings, Square Head and Hex Head Solid Plugs, Nipples, Unions, Steel Socket Weld Couplings and Caps.

CAP CAPITOL
MFG. & SUPPLY CO.
COLUMBUS, OHIO

COUPLINGS — NIPPLES — UNIONS — RADIANT HEAT FITTINGS — FURNACE COILS — WELL SUPPLIES — STEEL PIPE FITTINGS

Viking Operating Principle



Above are illustrated the major parts of the Viking Pump—casing, head, rotor and idler, separately and assembled. Imagine the rotor and idler in motion operating in a counterclockwise direction. Follow the course of the liquid from point of suction to point of discharge. Reverse direction will operate equally well. We invite your inquiries.

SOUTHERN ENGINE & PUMP COMPANY

MANUFACTURERS • MACHINERY FACTORS • CONTRACTORS

Houston - Dallas - Kilgore - San Antonio - Edinburg
Corpus Christi and Beaumont, Texas.

THE RECORD DISCLOSES A REVELATION

It's the LEE Electrical METHOD

A significant scientific development for locating under favorable geologic conditions new oil and gas fields. Also, for determining the sand extension from drilled wells for locating the best offset drilling location . . . thereby greatly reducing costly exploration and drilling failures.

Write for FREE BROCHURE

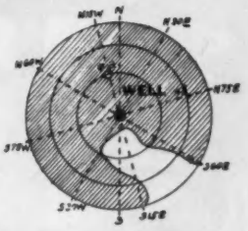
OIL

EXPLORERS! CORPORATIONS! (WILD-CATTING) — Get the Facts

With each well get a SANDEXMAP. It is an electric log mapping the sand pattern from the well running to the eight offset locations around the well. This pin points the best offset, avoids pinch outs and marginal portions of lease—thereby reducing waste and uncertainty in drilling operations.

STRIKE THE POROSITY CONTROLLED DEPOSITS OF OIL AND GAS AT SMALL COST

Dr. Frederick W. Lee, and his scientific trained Lee Organization, are engaged at the moment on important assignments. Write! . . . See how we can economically find a field, for you, if it exists.



THE LEE GEOPHYSICAL SURVEY COMPANY
110 E. LEXINGTON ST., BALTIMORE 2, MD.

UNIQUE— *FOR SWABBING*

AUTO-RELEASE wire line stripper

King 3-AR and 4-AR wire line strippers keep derrick floor clean and dry while swabbing or pulling wire-line cores.

Positive latch will not release by accident or a surge of pressure. Release mechanism operated by rope socket striking bottom of stripper.

Export: R. S. STOKVIS & SONS
17 Battery Place, New York 4, N. Y.

Send for catalog

KING OIL TOOLS
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ALWAYS IN OPERATION WHEN PUMPS ARE RUNNING

NEW MODEL RUMBA DE-SANDER

ALSO REMOVES SHALE

HUTCHISON MANUFACTURING CO.
6609 AVENUE U HOUSTON 11, TEXAS

What's Happening

AMONG SERVICE AND SUPPLY MEN

P. J. Moore

R. W. Wilson

R. E. Souther

C. J. Benefiel

William J. Miller

R. K. Epps

Donald C. Lamm

Stanley W. Hoig

George C. Thomas

A. O. Jones

Kenneth R. Stout

L. N. Lyon

Seventeen important promotions and transfers in six departments of **Baroid Division, National Lead Company** have been announced. **R. W. Wilson** has been named assistant manager, Technical Sales and Operations. Wilson was formerly manager of the Well Logging department.

R. E. Souther has been appointed manager of the Well Logging department, replacing Wilson. Souther was formerly manager of the Houston Equipment department. P. J. Moore succeeds Souther. He was formerly a sales engineer in the Equipment department. **C. J. Benefiel**, former transportation superintendent of Mud Products, Inc., at Tulsa, is now manager of the Transportation department with headquarters in Houston. **William J. Miller** has joined the Equipment department as pilot-engineer and will devote a portion of his time to the Engineering section of the department as a project engineer. With the addition of Miller to the staff, **C. W. Felker** has been appointed district superintendent of District 51 at Lake Charles, La. **W. G. Bealmear, S. E. Geffen** and **J. W. Maltby**, former district superintendents in Corpus Christi, Fort Worth and New Orleans, respectively, have been appointed area superintendents of well logging in southwest Texas, Mid-Continent and eastern Gulf Coast areas. **A. B. Lane** has been named well logging district superintendent in southwest Louisiana at Lafayette; he was formerly assistant district superintendent. Well Logging Captain **C. L. Apple, Jr.**, formerly stationed in British Honduras, has been made well logging district superintendent of northern Louisiana, Arkansas and East Texas with headquarters in Shreveport, La.

R. E. Haley, well logging district superintendent, has been transferred from Shreveport to Oklahoma City where he will supervise well logging operations in all of Oklahoma except the panhandle. **D. B. Reeves**, formerly well logging assistant district superintendent in Liberal, Kansas, has been appointed district superintendent in Kansas and the panhandle sections of Texas and Oklahoma. His assistant will be **T. W. English**, who was formerly a well logging captain. **V. R. Kayser** has been made well logging district superintendent in southwest Texas, with headquarters in Corpus Christi. He was formerly a well logging captain. The new Mud department district office in Houma, La. will be supervised by **G. G. Allen**, who was formerly area engineer in the Texas Gulf Coast with offices in Houston. His successor is **R. K. Epps**, who was formerly Mud department district sales representative in District 44 with headquarters in Corpus Christi. **V. S. Hefley** has been appointed district sales representative of Mud department District 44 at Corpus Christi. He was formerly a service engineer in the same district at McAllen, Texas. **Donald C. Lamm**, formerly with Rittenhouse & Company, Inc., and Foote, Cone & Belding, advertising agencies of Houston, has joined Baroid's advertising staff as assistant to the manager. Lamm's duties will be primarily in the production and graphic arts field. He will aid in the preparation of trade journal advertising, brochures and other direct mail pieces. **Stanley W. Hoig**, formerly with Douglas Aircraft Company in Tulsa, Okla., has also joined Baroid's advertising and publications staff as assistant to the manager. His duties will be primarily in the editorial field where he will be assistant editor of the Baroid News Bulletin and do work on the company's technical bulletins and handbooks. •

George C. Thomas has been named Oklahoma division sales engineer for Welex Jet Services. He will headquarter in Oklahoma City. Starting with Welex three and one-half years ago as a trainee, he has advanced to sales engineer, assistant district manager, and district manager prior to his present appointment. **A. O. Jones** has been appointed district sales engineer at Shawnee, Okla. A veteran of nine years experience in oil field service work, he has been with Welex for the past year. **Kenneth R. Stout** has been named district sales engineer at Great Bend, Kansas. He has been with Welex for 16 months and was a shooter prior to this appointment. •

L. N. Lyon will head **Boone and Cummings'** Industrial Advertising division. His previous employment includes Hughes Tool Company, Hughes Aircraft Strut Division, and most recently, Cameron Iron Works where he served as advertising manager. •

Eger V. Murphree, president of **Esso Research and Engineering Company** is taking one year's leave from the company to direct the nation's guided missile program. He is now special assistant to Secretary of Defense **Charles E. Wilson.** Murphree has been with the Jersey Standard organization since 1930. He worked on the Manhattan Project during World War II. •

Donald N. McCord has been named construction manager of **Stone and Webster Engineering Corporation** and assigned to the Boston office. McCord has been with Stoné and Webster since 1941. Since then, his work has included participation in the Manhattan project at Oak Ridge, Tenn., large hydroelectric developments in Washington and construction of the Shamrock Hotel (now Shamrock-Hilton) in Houston. •

Lane-Wells Company announced the following location and personnel changes. Recently a truck station was opened in

WHY you get greater Blowout Protection with KOOMEY Blowout Preventer CLOSING UNITS and S. & S. "Power Packaged" ACCUMULATORS!

Feature for feature, KOOMEY Closing Units and S. & S. Accumulators provide the positive dependability necessary for today's deep hole and offshore operations. Write today for performance specifications and detailed information on all models or contact the representative in your area.

STEWART & STEVENSON DISTRIBUTING CO.

STEWART & STEVENSON DISTRIBUTING CO.

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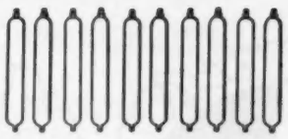
HOUSTON, TEXAS

AGENTS

- Doug Meador,
  New Orleans, Louisiana
  Phone ED 1-1842 or AU-2611
  Lafayette, Louisiana
  Phone CE 5-7484
- Roger Smith,
  Townsend Hotel, Casper, Wyoming
  Phone 2-2631
- Acme Oil Tool Co.,
  1037 S.E. 29th St.,
  Oklahoma City, Oklahoma
- Stewart & Stevenson Services,
  Midland Highway, Odessa, Texas

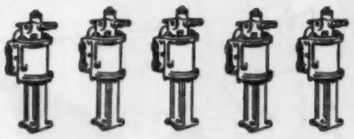
EXPORT

- Ed. Carney,
  Stewart & Stevenson Distributing Co.,
  74 Trinity Place,
  New York 6, New York



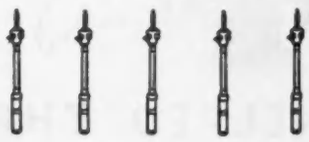
3 TO 10 ACCUMULATORS

Individual ten-gallon accumulator bottles (3000 psi working pressure) in manifold to form a compact system that will operate even if several of the nitrogen filled bags within the bottles should fail.



2 TO 5 MOTORS

Heavy duty units which require no oiling or maintenance . . . completely separated from pumps for ease of repair and to eliminate danger of material being pumped seeping into motor.



2 TO 5 PUMPS

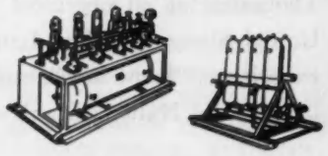
Each double action pump assembly is operated by a separate motor and each motor and pump assembly is capable of closing the rams of a blowout preventer independently.

QUICK PUMP CHANGE

All a roughneck needs to do to change pumps is break one union, substitute an exchange pump and tighten the union. Thoroughly tested, guaranteed pumps are available for exchange.

REMOTE CONTROLS

Added safety is provided by dual controls—one set on the rig floor and the other at a safe distance from the rig.



WIDE RANGE OF MODELS

Specifically designed models are available to meet the requirements of each type of blowout preventer, and components may be assembled into custom-made units to solve specific problems.

Artesia, N. M. The Okmulgee, Okla. station has been closed and its activities transferred to Seminole. **T. W. Lindsey** has been transferred to Houston as area manager. **M. P. Mathew,** formerly with Lane-Wells Canadian Company replaces Lindsey at Hobbs. **Don Norden** has been named district logging and mechanical engineer at Farmington, N. M., replacing **Jesse Smith,** who transferred to the Division Logging department at Oklahoma City. **John L. Morton** has been transferred from Kimball, Neb. to Riverton, Wyo. as station manager. **Wayne E. Campbell** has been transferred from Sterling, Colo., to Kimball as field service operating engineer in charge. **Bob G. Murphy** has been named safety engineer of the Mid-Continent division with headquarters at Oklahoma City.

Joy Manufacturing Company of Pittsburgh has announced the appointment of **William Hanson, Jr.,** as manager of Conveyor Products at the New Philadelphia plant. Before joining the Joy organization in 1951 Hanson worked as a private engineering consultant. He started with Joy as a designer, later moving to assistant manager of Conveyor Products.

•

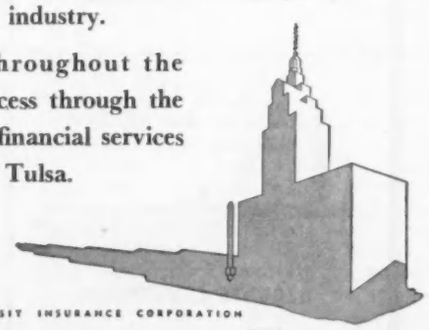
C. E. Douglas was appointed controller of the White Diesel Engine division of the **White Motor Company** it was announced. Douglas formerly was assistant to the vice president—finance of White Motor, which is headquartered in Cleveland. He also has served as assistant to the general manager of White Motor's Coach division and as an economist for the U. S. Government.

ATLANTIC TO PACIFIC . . .
GREAT LAKES TO MEXICO!

NBT HAS HELPED THE OIL INDUSTRY GROW

From the early days of oil development in Oklahoma "The Oil Bank of America" has justly earned its recognition and patronage from the great and growing petroleum industry.

Thousands of oil operators throughout the United States have found success through the experience, "know how", and financial services available at National Bank of Tulsa.



MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

NATIONAL BANK OF TULSA

The Oil Bank of America

OFFERING COMPLETE BANKING AND TRUST SERVICES

Frank J. Curley

John E. Bruce

Frank J. Curley has been promoted to vice president and resident manager and **John E. Bruce** to service manager for **Johnston Testers, Ltd.** Curley formerly was sales manager for Johnston, joining the company in 1951. His first assignment was in the Service department, and he moved from there into the Sales section. Prior to joining Johnston, he had worked as a roughneck and as a service engineer for drilling contractors, producing companies and a service company. Bruce, formerly district manager in Regina, Saskatchewan, joined Johnston in 1951 as a service man in Edmonton after being associated with Imperial Oil. Since that time he has worked in all active areas in Canada.

•

R. E. Ligon, formerly field representative at Sweetwater, Texas, has been promoted to store manager and field representative for **Bethlehem Steel** at that point. **E. T. Broughton,** machinery sales representative for the Kansas district, was just recently moved from Great Bend to the Wichita district office, where he will now be based. The duties of **W. A. Nestlerode,** special representative at Denver, have been broadened to cover all production sales problems in the Rocky Mountain district. He will continue to base at Denver but will be available for engineering service on water flood and kindred projects throughout the district.

•

Max D. Rizley has joined the Legal department of **Dowell Incorporated,** Tulsa, Okla.

•

C. Wayne Millis, formerly district manager at Fort Morgan, Colo., has been transferred to Farmington, N. M. where he will serve as district manager for **Schlumberger Well Surveying Corporation.** He joined the company in 1947. **Gale T. Bradshaw** is the new district manager at Liberal, Kansas. Bradshaw has served Schlumberger since 1951 as field engineer in Russell and Medicine Lodge, Kansas **F. D. Fulkerson,** formerly field sales engineer at Roswell, N. M., has been named district manager at Kermit, Texas. He joined Schlumberger in 1947. **H. T. Carson** leaves his former position as division engineer at Corpus Christi, Texas, to become district manager at Falfurrias, Texas. Carson has been with Schlumberger since 1950. The new Alice district manager is **Floyd A. Rice.** He joined Schlumberger in 1945.

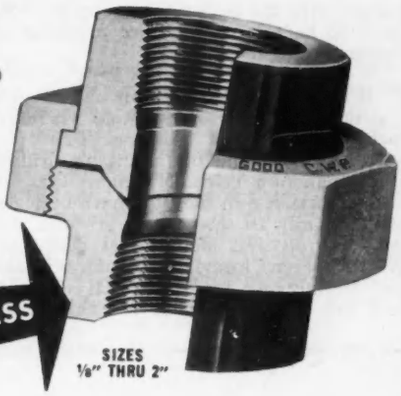
•

Robert H. Stewart has recently been appointed to head the Sales department of the **Lane-Wells Company** technical oil field service for the El Dorado area. He is replacing **Tom Bush,** who has been promoted to the company's Wichita, Kansas, office.

NEW petro 6000 LBS. C.W.P.

FORGED STEEL UNIONS

Ideal for High Pressures of Gases or Liquids, Hot Oils, High Temperatures, Ammonia Hot or Cold & Power Piping



HEAVIER WALL THICKNESS

SIZES 1/8" THRU 2"

- The wall thickness of this New Petro Union has been greatly increased to easily withstand the severe demands of higher pressures and hot or cold temperatures. It is drop forged from uniformly heated steel forging bars. Grain and fibre structure are refined through the controlled hammer impact on the hot, plastic metal as it is confined in the closed dies. The hot forging develops the tensile and torsional strength, the toughness and fatigue endurance required to enable the finished Union to resist the most complex stresses and strains ever present in high pressure and high temperature piping systems.
- Nuts are octagon in shape and are Udylited. The nut threads are rust-proof, spark-proof and permanently lubricated with Udylite Cadmium.
- The ends are also octagon in shape to provide flat gripping areas for wrenches.
- The ends are tapped, sharp and clean, per American Standard B 2-1 1945 (for tapered pipe threads).

THE "ECONOMY PLUS" UNION

You'll get greater ruggedness, dependability and service with a minimum of downtime or maintenance time. Considering the original low cost it's the most economical Union you will ever buy.

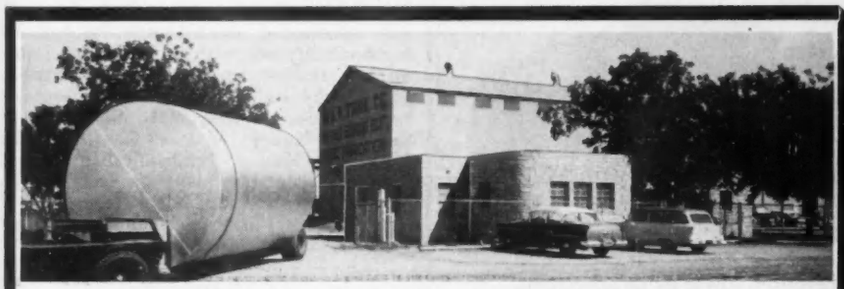
MAIL THIS COUPON TODAY!

PLEASE SEND US COMPLETE INFORMATION ON THE 6000 LB. PETRO

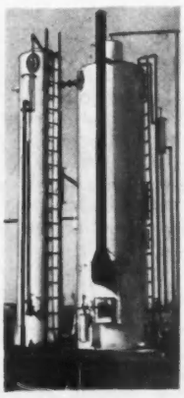
NAME_____

ADDRESS_____ CITY_____ ZONE____ STATE_____

CLAYTON MARK & COMPANY • 1900 Dempster Street • Evanston, Illinois



Our complete and modern facilities assure sound design, reliable manufacturing, and prompt, efficient service to every customer.



LOW PRESSURE TREATING UNIT WITH HIGH VOLUME WATER KNOCKOUT

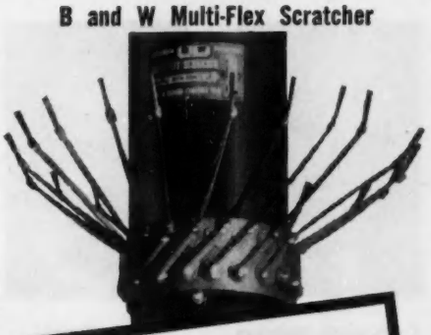
Solves the problems of large water volume and B.S. content on water flooding projects. Complete range of sizes stocked for immediate delivery. Pictured: 6′ x 24′ Type H-E Treater and 4′ x 26′ Water Knockout.

TANKS - TREATERS - SEPARATORS

Steel Fabrication for the Oil Industry

MFD BY M&V TANK COMPANY WICHITA FALLS, TEXAS

B and W Multi-Flex Scratcher



B and W Inc.

For a good cement job

B and W Automatic Stop Collar

B and W Latch-On Centralizer

Also: B and W Multi-Flex Scratcher • Hinged Nu-Coil Scratcher • Rotating Scratcher, Multi-Flex type • Rotating Scratcher, Nu-Coil type • Latch-On Centralizer with Kon-Kave Bow • Latch-On Stabilizer • Stabilock

B and W Inc.

Well Completion Specialists

GULF COAST	WEST COAST
Box 5266	Box 3751, Terminal Annex
Houston 12, Texas	Los Angeles 54, California
Phone WA 3-6603	Phone DA 4-1106

6352

F. Kenneth Morrison

C. B. Truitt

F. Kenneth Morrison has been named president and general manager of the Mason-Neilan division of Worthington Corporation. He succeeds **Eldon Macleod**, who is retiring after 43 years. Starting with the Mason Regulator Company in 1924 as a salesman, Morrison was promoted to general sales manager in 1927 and continued in that capacity after the merger with the Neilan Company in 1931. In 1933 he was elected vice president in charge of sales.

•

C. B. (Ike) Truitt has been named general sales manager for the **Rolo Manufacturing Company** of Houston. Truitt is well known in the oil industry's drilling and production fields. His more than 20 years experience in industry have been devoted mainly to work with pressure vessels, controls and metering of crude oil. W. M. Boren, formerly director of sales and engineering for Rolo, will now devote full time as director of engineering.

5 reasons why ELGEN provides the best electronic well logging service available

1. New and improved equipment!
2. A highly qualified research staff!
3. Advanced interpretation techniques!
4. Fast, on-the-well service when you need it!
5. Skilled and long experienced field engineers!

ELGEN gives you accuracy, sound interpretation, lower price schedules, minimum rig time. Join the operators who are turning to ELGEN for the most satisfactory logging service to be found.

DIVISION OFFICES AND SERVICE LOCATIONS

Wichita Falls, 906 Staley Bldg., Tel. 2-2113
Ballinger, 710 Strong Ave., Tel. 2-1062
Abilene, 1433 Cherry St., Tel. 4-4445
Oklahoma City, 509 Cravens Bldg., Tel. RE 6-3669
Shawnee, 2000 N. Harrison St., Tel. 6860
Duncan, 219 Ritz Bldg., Tel. 3490
Fort Morgan, Colo., 218 Ensign St., Tel. UN 7-7163
Graham, 100 Elm St., Tel. 1000
Gainesville, 423 Cuiberson St., Tel. HO 5-2322
Tyler, 211 North Hill St., Tel. 2-2430
Tulsa, 219 Oil Capital Bldg., Tel. GI 7-7610
Ponca City, 208 S. Second St., Tel. RO 2-1796
Cushing, 101 East Broadway, Tel. 795
Kimball, Nebr., 703 E. Second St., Tel. 266

THE ELGEN CORPORATION

ELGEN ELECTRONIC WELL LOGGING

2925 MERRELL ROAD, DALLAS, TEXAS

James F. Beré has been appointed general manager of the **Axelson Manufacturing Company,** Los Angeles, a division of U. S. Industries, Inc. For the past year and a half, he has been general manager of the Hamilton, Ohio, plant of Clearing Machine Corporation, another division of U. S. Industries, Inc.

Howard W. Carlisle, formerly assistant sales manager of the Clearing division, will succeed Beré as general manager of the Hamilton plant of Clearing.

•

Robert Lee Alder, with **Lane-Wells Company** since 1940 and research supervisor since 1952, has been made research manager with headquarters at San Gabriel, Calif. Alder will be in charge of all basic and applied research in shaped-charge and bullet perforating as well as research relating to new products and field services. Replacing Alder as research supervisor is **Dr. A. L. Floyd** who will have technical supervision of the research project.

•

Howard N. Hawkes, vice president, has been elected a member of the board of directors and member of the executive committee of **United States Rubber Co. G. Raymond Cuthbertson** has been elected a vice president and named general manager of the tire division succeeding Hawkes. **John W. McGovern** has been elected executive vice president of the company. He will succeed **H. Gordon Smith,** who retired, but who will continue as a member of the board of directors. McGovern was also elected vice chairman of the company's executive committee.

•

John V. Banks has been named production manager of **Kaiser Steel Corporation's** Fabricating division, Montebello plant, it was announced. Banks brings to his new responsibility more than 10 years of production management experience. Prior to joining the staff at the Montebello plant he was vice president of manufacturing for the Kaiser Motors Company. He joined the Kaiser organization in 1946 at the auto assembly plant in Long Beach. In his new position he will oversee all structural steel and special products manufactured at the Montebello plant.

•

Leon Cherksey became chairman of the board and **Gerald C. Romig** succeeded Cherksey as president of the **American Chemical Paint Company.** As chairman of the board, Cherksey is the first officer in the company's history to serve in this new capacity. The new chairman has been with ACP 37 years having joined the firm in 1919. He became secretary-treasurer in 1930, and in 1939 he became ACP's president. Romig came with ACP in 1927 and has worked in the Research and Development department and as vice president. Both are on the board of directors of the company.

•

Allen M. Harrelson has been named vice president and treasurer of **H. K. Porter Company, Inc.** Harrelson will have his offices in the company's Pittsburgh headquarters. Before joining Porter, he was controller of Scaife & Cox, Pittsburgh, and prior to that had been with Peat, Marwick and Mitchell.

•

Maurice M. Muse has been appointed district sales representative for **Leschen Wire Rope Division, H. K. Porter Company,**

Inc. His territory includes the eastern two-thirds of Kentucky and Tennessee and the northern half of Alabama. Muse has had 14 years experience selling wire rope in the same territory, part with American Chain & Cable Co., and part with McCarthy, Jones & Woodard, distributors.

•

Charles L. Sullivan, Jr., has been made division engineer for the **Schlumberger Well Surveying Corporation's** North Central Texas division. He will be stationed at Abilene, Texas. His duties will involve the training of division personnel in the maintenance and operation of the more complex surveying instruments.

•

Michael Montalbano has been appointed director of computer research of **Kaiser Steel Corporation.** He will be located at the company's home office, Oakland, Calif.

In his new position, Montalbano will direct the application of data processing equipment and mathematical techniques to Kaiser Steel's operations both at the home office and the steel mill at Fontana, Calif.

Montalbano has been with Kaiser Steel since 1954 as a mathematician at the Fontana mill. Formerly, he was a mathematician with the U. S. Government for six years in Washington, D. C., first with the National Bureau of Standards and later the Naval Research Laboratory.

•

C. C. Littlefield, Jr., has been transferred by **Sperry-Sun Well Surveying Company** from Lafayette, La., to Odessa, Texas, where he will assume duties of district manager of the Sperry-Sun West Texas area operations. Littlefield has been with Sperry-Sun since 1950, having worked in the sales offices in Houston, Corpus Christi and Lafayette before moving to Odessa. **Bill Angelle,** salesman in the Lafayette office for the past one and a half years has been promoted to district manager of the Lafayette sales office.

•

E. E. Andreason and **E. R. Lundberg,** of New York City, will handle foreign business for the **George E. Failing Company** of Enid, Okla. The Failing Company, a subsidiary of Westinghouse Air Brake Company, manufactures portable rotary rigs.

•

Joy Manufacturing Company announced significant changes in the company's organizational structure which involve the establishment of three new general management positions at the vice presidential level. **Hugo C. Nyquist** has been named to the newly created post of vice president and general manager of the firm's Coal Machinery division; **James A. Drain** has been appointed vice president and general manager of the new Mining and Construction division; and **Louis G. Helmick** is Joy's new vice president and general manager of the Industrial division. Prior to this appointment, Nyquist had been general sales vice president at Joy. He joined the company in 1946. Drain, with the organization since 1941, retains his position as president of Joy's Canadian subsidiary. Helmick had been serving as vice president of manufacturing for the parent company, and has been associated with Joy since 1947.

•

Joseph G. Walsh was appointed manager of the **U. S. Steel Corporation** Oil Well Supply division store at Dawson Creek, B. C. Walsh was employed in 1952 at Edmonton, Alta., and in 1955 was transferred to Virden, Man. In January of this year he was appointed field representative at Estevan, Sask., the position he held prior to his new appointment.

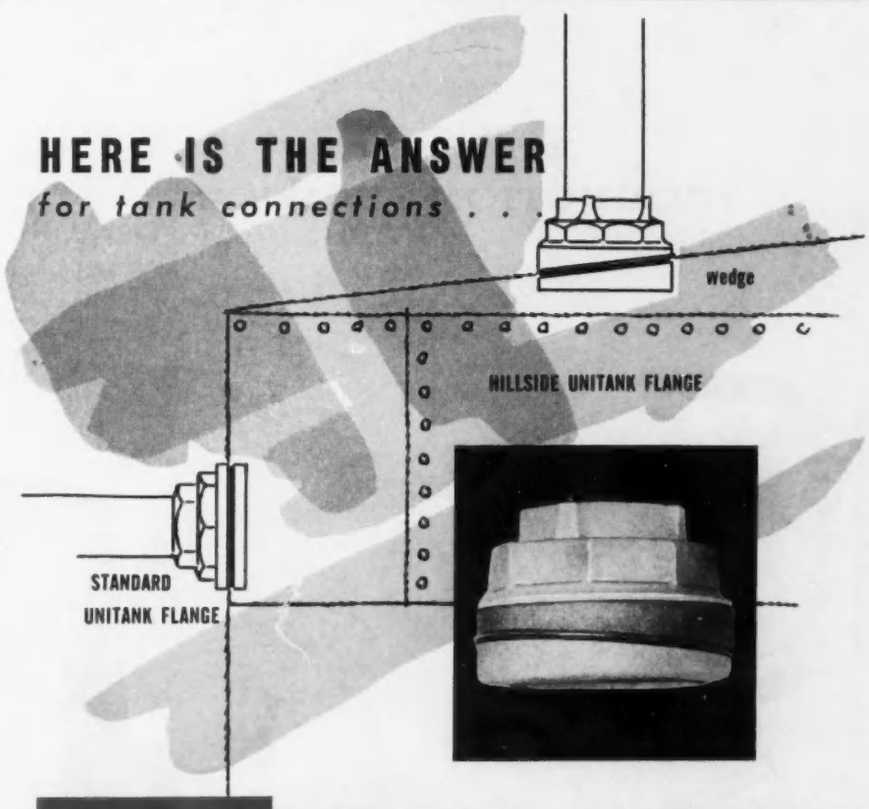
•

Dillon Anderson has been elected a member of the advisory board of **Texas National Bank** of Houston. He recently returned to Houston from Washington after serving 18 months as special assistant to President Eisenhower on National Security Affairs. He resigned that post to resume his partnership in the Houston law firm, Baker, Botts, Andrews and Shepherd. Previous to Anderson's governmental service, he was a member of the board of Texas National Bank. He is also a trustee of the Carnegie Foundation.

Carra L. Lane

Ott Hammer

Carra L. Lane is the new president of Security Engineering division, one of the Dresser Industries. This Dresser company is a manufacturer of drilling bits and other drilling tools, and has plants both



ENARDO UNITANK FLANGES

The ENARDO Unitank Flanges are made to fit either flat decks (Standard) or sloping decks (Hillside). They are cast of sturdy metal, precision machined, easily installed, and economical because of labor saved at installation. The "Hillside" flange consists of a body, wedge, and retaining nut, designed for connections on the slope of standard tank decks. This flange keeps all overhead piping vertical. Not at an unknown angle, i.e. a standard flange on sloping deck. (See illustration.) The "Standard" flange consists of a body and retaining nut. It is designed for installation on all tank walls. On both type flanges, body extends through tank plate from the inside with gasket between body and plate. Retaining nut is tightened from outside (see illustration). Left-hand threads are machined on both body and retaining nut; this causes the flange to tighten instead of loosen when receiving standard pipe, from either the inside or outside. Only one hole needed for "Hillside" or "Standard" flanged installation. Both flanges have had universal acceptance in the oil fields.

Call, write or wire ENARDO for further information.

ENARDO manufacturing company
BOX 1647 TULSA, OKLA

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

in Dallas and in Whittier, Calif. Lane's appointment follows upon the promotion of **Ott Hammer** to a vice presidency of Dresser. Hammer has been associated with Security since its founding in 1931 and has been president of Security since May, 1947.

R. W. Reekstin

Russell W. Keener

R. W. Reekstin recently was appointed chief engineer, Petroleum Equipment Products, for the **Axelson Manufacturing Company**, division of **U. S. Industries, Inc.** Formerly Reekstin was in charge of the Petroleum Technical Service group as engineering manager. In his new capacity, he will be in charge of engineering for pumps and rods as well as Axelson's complete line of hydraulic surface pumping units.

•

Russell W. Keener has been appointed coordinator, Foreign Sales & Service of **Lane-Wells Company**, one of the Dresser Industries. Keener brings a wealth of experience in foreign sales, administration and operations to his new position, having been vice president and one of the organizers of Petro-Tech Service Co. handling Lane-Wells Services and products in Venezuela since 1946. Prior to that time he had been with Lane-Wells since 1941 in administrative duties and as purchasing agent.

•

Jones & Laughlin Supply division, Tulsa, Okla., announced the recent appointment of **John P. Gregor** as sales representative, drilling equipment. Gregor will be headquartered in the firm's Houston sales office and will promote the sale of drilling equipment in the entire Texas and Louisiana Gulf Coast districts. He will be responsible both for direct contacts and for assistance to the firm's sales force in the southern Louisiana, south Texas and southwest Texas districts. Prior to joining J&L Supply last June, he held the position of general merchandise manager at the Unit Rig & Equipment Company in Tulsa.

C. R. Parker

David A. Elliott

C. R. Parker has been named credit manager for **Welex Jet Services, Inc.**, with offices in the Fort Worth headquarters of the company. He has been associated with Welex for the past seven and one-half years, having served as sales engineer, district manager and assistant division manager prior to his present appointment. He has been associated with the oil industry for 10 years, having been a drilling contractor, production foreman and geologist before joining Welex.

•

David A. Elliott is the newly appointed Electro-Span applications engineer for the eastern area, it was announced at Pacific division, Bendix Aviation Corporation. Elliott's duties include sales and service of the telemetering equipment in the East. Formerly with the Bendix Radio Division in Baltimore, Md., Elliott transferred to the West Coast in 1954. Previous experience includes work as a field engineer for the Government Service division of RCA Service Co., where he was concerned with airborne communications and radar. He also was associated with Boeing Aircraft, Wichita, Kansas, as a test engineer for navigational computers and associated radar equipment.

•

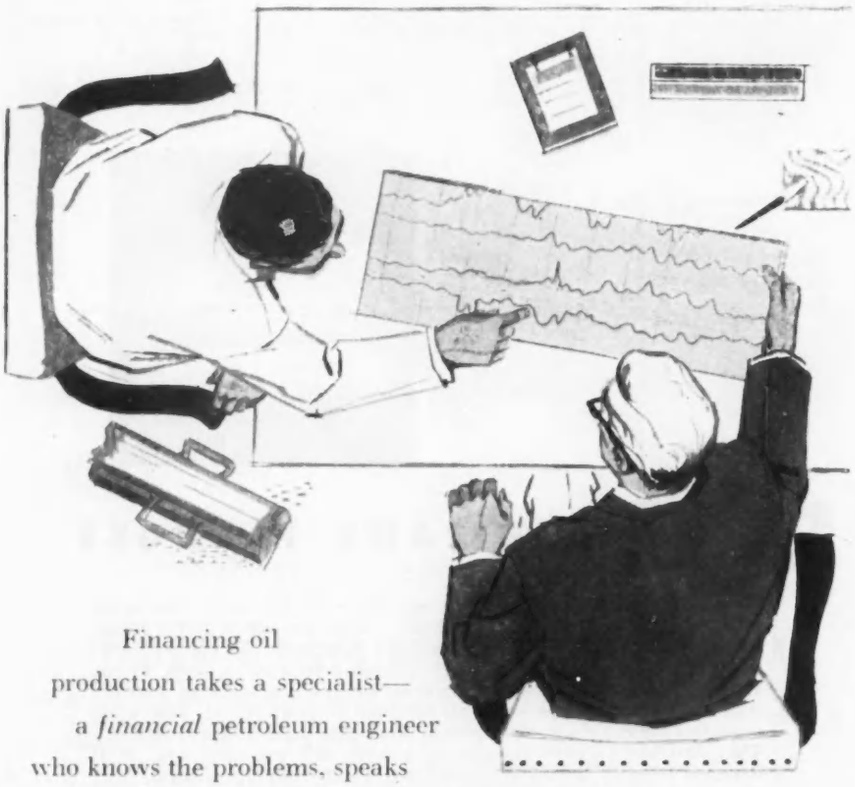
Dr. Griffin D. Jones has assumed new responsibilities as director of **The Dow Chemical Company's** Physical Research Laboratory. He succeeds **Dr. W. C. Bauman** who recently was named director of research for the company's Chemicals department. With the company for the past nine years, Dr. Jones was appointed assistant director last May, moving up from division leader to replace **Dr. Turner Alfrey** who became head of the Polymer Research Laboratory. Author of a number of papers and credited with more than a dozen patents in the polymer field, Dr. Jones was an instructor in organic chemistry at the University of Iowa and a research chemist at the General Aniline and Film Corporation before joining Dow in 1947.

•

The Republic Supply Company has promoted **A. D. (Andy) May** to the position of manager of their Ellinwood, Kansas, store. May joined the Republic organiza-

Let's talk over your

PRODUCTION FINANCING



Financing oil production takes a specialist—
a *financial* petroleum engineer
who knows the problems, speaks
the language of the producer.
Texas National's financial engineers
have many years of experience in financing
oil production which can be put to work for you.
Come in and let's talk it over.

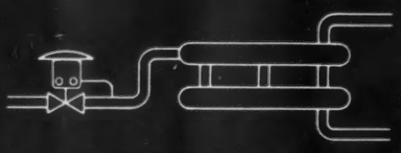
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

TEXAS National BANK
OF HOUSTON

FISHER®

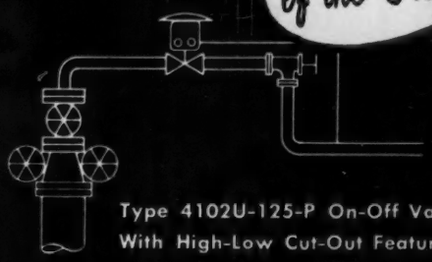
Hi-Low Cutout Controllers

The Sentinel of the Field



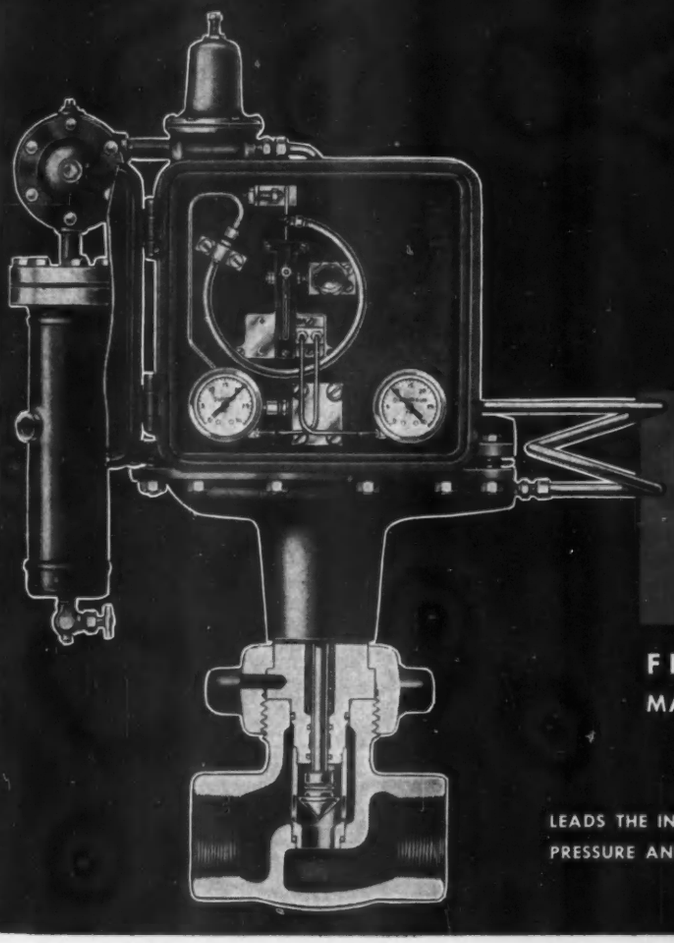
Type 4102UR-125-P Field Valve With Low Pressure Cut-out Feature

Always on guard, the Fisher Type 4102UR pilot when installed in gathering lines will throttle or reduce the pressure to separators and will automatically close if a break in the line occurs, thus protecting the system from costly loss.



Type 4102U-125-P On-Off Valve With High-Low Cut-Out Feature

Ideal as a high-low pressure well head safety valve. Will stay open, but will automatically close if pressure goes above pressure limitations of downstream piping. Will also close if pressures fall too low *due to* a break in downstream system.



- Wizard available with bronze or steel Bourdon tubes up to 5000 psi.
- Rugged and compact—entire controller not over 2 feet high.
- Series 125–P field valve supplied with heavy cast steel body good for 2000 psi.
- Topwork action reversible in field with no additional parts.

SPECIFICATIONS

Body—Cast Steel—2000 psi WOG.
Sizes—1" and 2" screwed angle or globe.
Orifice Size—1" Body—⅛", ¼", ⅜", ½". 2" Body—⅛", ¼", ⅜", ½", ¾", 1".
Valve Cage—440 hardened St. Steel. (Tungsten carbide insert also available.)
Inner Valve—440 hardened St. Steel. (Tungsten carbide tip also available.)

FISHER GOVERNOR COMPANY
MARSHALLTOWN, IOWA • WOODSTOCK, ONTARIO

LEADS THE INDUSTRY IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

FISHER *Since 1880*

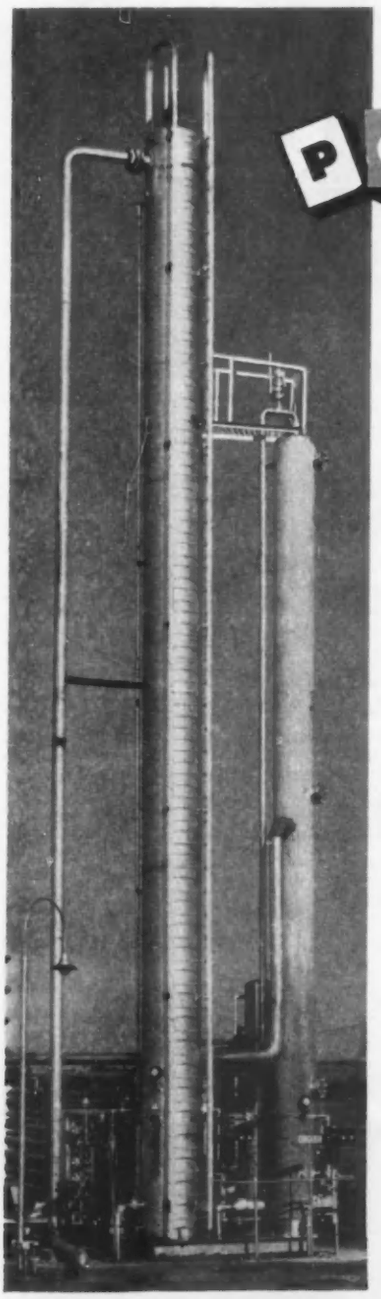
tion in 1950 at Odessa, Texas, and since that time has been located at Kermit, Texas, Bartlesville and Pawhuska, Okla., in field and city sales work.

•

The Maloney-Crawford Tank & Manufacturing Co., Tulsa, Okla., announced the election of **M. R. Liles** to president and chief executive officer; **T. J. Latta** to the position of treasurer; **S. P. Wallace** to the newly created post of chairman of the board; **F. L. Bruckner**, vice president and secretary; **L. G. Rader**, vice president in charge of sales; and **E. C. Kopp**, vice president.

•

Continental Supply Co. announced the following changes in personnel and sales territories. Headquarters for Continental's West Texas-New Mexico division is relocated in Midland, Texas. Fort Worth, former headquarters for this division will now be a sales office with **C. A. Ross** as the sales office manager. **R. L. Collier** is division manager for the West Texas-New Mexico sales division. The oil field supply company's district office at Midland, Texas, was moved to Odessa. From his new location, **W. T. Hays**, district manager, will have jurisdiction over Continental stores at Andrews, Kermit, Hadacol Corners, McCamey, Monahans and Odessa, Texas. The district office at Hobbs, N. M., has been moved to Lubbock, Texas. **W. H. Long, Jr.**, district manager, will work with the Lubbock office and the Hobbs and Tatum, N. M. stores as well as Post and Sundown, Texas stores. **J. B. Patterson** will be district manager over a newly created sales district in the panhandle of Texas. Headquartering at Amarillo, Patterson will have responsibility for city sales at Amarillo and stores located at Farmington, Pampa and Borger.



PORTABLE

gasoline plant

The McNamar portable gasoline plant is designed for flexible application and automatic operation.

The simplicity in design, the ease of moving from one location to another and the dependable operation are factors that greatly reduce operating and maintenance costs.

McNamar portable gasoline plants can be used to control the hydrocarbon content of the sales gas, to economically recover gasoline and LPG, and to process the expanding gas production in an undeveloped field.

For dependable, economical and automatic portable gasoline plants, you can be assured of quality when you deal with McNamar.

Call, write or wire McNamar for further information.

McNAMAR BOILER & TANK CO.

Box 868 • CHerry 2-6291 TULSA, OKLA.

Philip L. McLaughlin

Ralph A. Purcelli

Schramm, Inc., has announced the formation of a Petroleum division to be headed by **Philip L. McLaughlin**, former drilling editor, WORLD OIL magazine, and more recently director of drilling research, Cardwell Manufacturing Company. Schramm's new Petroleum division will function as a separate sales and research branch of the parent company but will use some of the existing dealer and sales organization to actively promote newly designed equipment for air drilling and other petroleum industry applications. McLaughlin, who will coordinate the activities is internationally known for his writing and editorial coverage on new and improved drilling techniques. He formerly served as an executive assistant to **H. W. Cardwell, Sr.**, president of Cardwell Manufacturing Company, until its acquisition by **John W. Mecom**, Houston oil man, this year. McLaughlin was in charge of Drilling Research, Advertising and Sales Promotion. Under Mecom his duties were expanded to include market research director.

•

Ralph A. Purcelli, former assistant general manager of **Rockwell Manufacturing Company's** gas regulator plant at Norwalk, Ohio, has been named general manager of the new Rockwell plant at Statesboro, Ga. He joined Rockwell in 1936, became general foreman of the Nordstrom Valve department at Pittsburgh in 1943, general foreman of meter and regulator assembly in 1950, general superintendent of the Barberton, Ohio, valve plant in 1951 and assistant general manager at Norwalk in 1954.

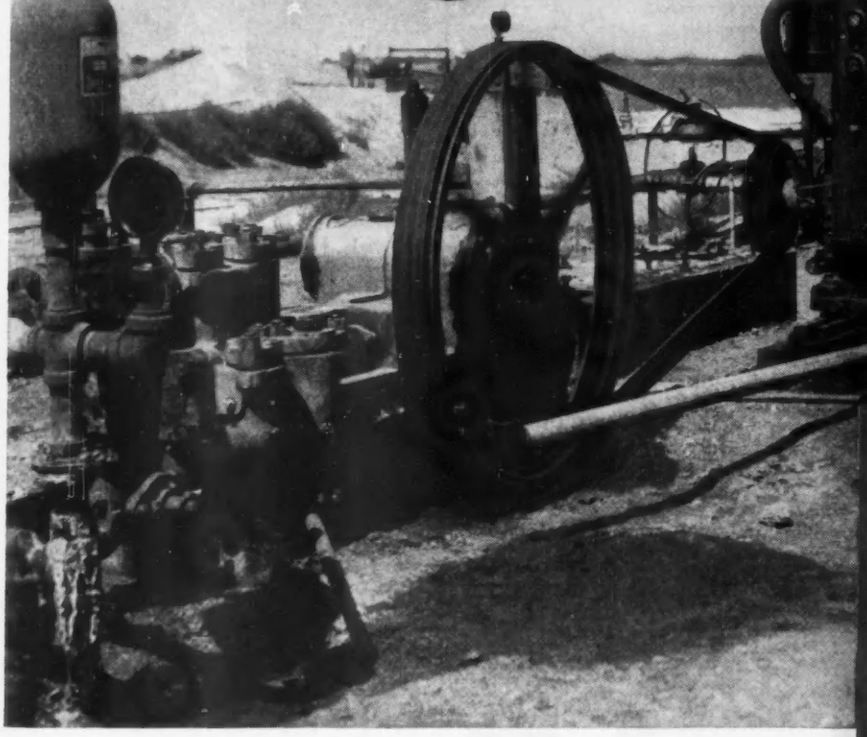
John W. Hendryx

J. E. Kelly

John W. Hendryx has been promoted from sales engineer to product sales manager for packaged compressors, and **J. E. Kelly**, formerly service engineer, has been named chief service and office engineer for J. B. Beaird Company, Inc. The two men will

for Dependability and Economy Standardize on RED SEAL POWER

CONTINENTAL MOTORS · Powerful as the Nation · AMERICA'S STANDARD ®



The petroleum industry's widening use of Red Seal engines traces mainly to two factors. One is the broad diversification of the Red Seal line—more than 100 basic models, from 14 h.p. to 1,000-plus*, for use on all standard fuels . . . The other is Continental's long standing reputation for dependability—their inbuilt capacity to deliver more power, longer, at lower cost. Ask for them at your supply store.

*High-output air-cooled military models developed jointly by Army Ordnance and Continental are now available for commercial applications where high output (375 to 1,000-plus h.p.) low weight, and exceptional compactness are required. For information, address Continental Motors Corporation, Military Division, 76 North Getty Street, Muskegon, Michigan.

1955 WINNER NATIONAL SAFETY COUNCIL PUBLIC INTEREST Award

PARTS AND SERVICE EVERYWHERE

GASOLINE AND LPG ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
N56	4	2¼	3½	56	14.4 @ 2200 RPM
N62	4	2⅜	3½	62	15.3 @ 2200 RPM
Y69	4	2½	3½	69	21.4 @ 2400 RPM
Y91	4	2⅞	3½	91	28.5 @ 2400 RPM
Y112	4	3 1/16	3½	112	32.0 @ 2400 RPM
F124	4	3	4⅜	124	36.5 @ 2400 RPM
F140	4	3 1/16	4⅜	140	42.0 @ 2400 RPM
F162	4	3 1/16	4⅝	162	49.0 @ 2400 RPM
F186	6	3	4⅜	186	60.5 @ 2400 RPM
F209	6	3 1/16	4⅜	209	68.0 @ 2400 RPM
F226	6	3 5/16	4⅜	226	73.0 @ 2400 RPM
F244	6	3 7/16	4⅜	244	79.0 @ 2400 RPM
M271	6	3⅝	4⅜	271	86.2 @ 2400 RPM
M290	6	3¾	4⅜	290	92.2 @ 2400 RPM
M330	6	4	4⅜	330	104.4 @ 2400 RPM
M363	6	4	4 13/16	363	128.9 @ 2800 RPM
B371	6	4⅛	4⅝	371	110.0 @ 2400 RPM
B427	6	4 5/16	4⅞	427	127.0 @ 2400 RPM
G134	4	3⅛	4⅜	134	34.2 @ 2000 RPM
G157	4	3⅜	4⅜	157	40.0 @ 2000 RPM
E201	4	3⅝	4⅞	201	65.4 @ 2400 RPM
H227	4	3⅝	5½	227	54.0 @ 1800 RPM
H243	4	3¾	5½	243	57.9 @ 1800 RPM
H260	4	3⅞	5½	260	62.0 @ 1800 RPM
H277	4	4	5½	277	66.4 @ 1800 RPM
K363	6	4	4 13/16	363	123.0 @ 2400 RPM
J382	4	4½	6	382	74.0 @ 1400 RPM
T371	6	4⅛	4⅝	371	119.0 @ 2400 RPM
T427	6	4 5/16	4⅞	427	140.0 @ 2400 RPM
U501	6	4½	5¼	501	159.0 @ 2400 RPM
R513	6	4½	5⅛	513	164.3 @ 2400 RPM
R572	6	4¾	5⅛	572	182.4 @ 2400 RPM
R602	6	4⅞	5⅛	602	191.7 @ 2400 RPM
V603	8	4¼	4¼	603	220.0 @ 2800 RPM
S749	6	5⅛	5½	749	217.0 @ 2200 RPM
S820	6	5⅛	5½	820	237.0 @ 2200 RPM

CUSHIONED POWER DIESEL ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
ZD129	4	3¼	3⅞	129	34.0 @ 2000 RPM
GD157	4	3⅜	4⅛	157	39.0 @ 2000 RPM
*ED201	4	3⅝	4⅞	201	45.8 @ 2000 RPM
HD243	4	3¾	5½	243	55.0 @ 2000 RPM
*HD260	4	3⅞	5½	260	59.0 @ 2000 RPM
*HD277	4	4	5½	277	63.2 @ 2200 RPM
*JD382	4	4½	6	382	72.5 @ 1600 RPM
TD427	6	4 5/16	4⅞	427	106.0 @ 2000 RPM
RD572	6	4¾	5⅛	572	154.0 @ 2000 RPM
VD603	8	4¼	4¼	603	175.0 @ 2600 RPM
SD802	6	5 5/16	5½	802	202.0 @ 1800 RPM

*Available for industrial applications only.

Continental Motors Corporation

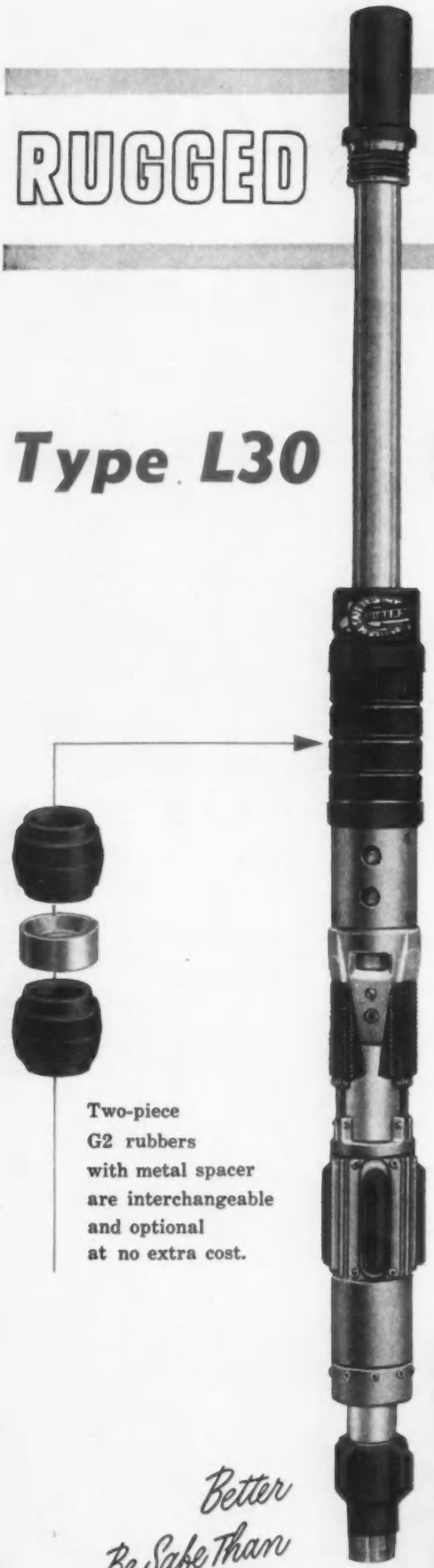
MUSKEGON • MICHIGAN

6 EAST 45TH STREET, NEW YORK 17, NEW YORK • 6218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 3817 SOUTH SANTA FE AVENUE, LOS ANGELES 58, CALIFORNIA • 1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GEORGIA

RUGGED AND RELIABLE

GUIBERSON'S

Type L30 Deep Well Packer



Two-piece G2 rubbers with metal spacer are interchangeable and optional at no extra cost.

For deep well work with high temperatures and pressures, use Guiberson's dependable L30 Packer. It will give you long valve travel (30 inches) with minimum overall length at no extra cost. You can pull the L30 surely and safely. The fast-action automatic latch, protected by a positive anti-lock device that assures ready release, snaps easily into latched position. Tough, long-wearing friction pads supply ample drag. Packing rubbers of advanced design will not vulcanize to the casing wall. All these features are available on the L30 or the L8 with 8" valve stroke in a wide range of casing sizes. For circulating *above* the packer, Type L30P or L8P with perforated mandrel is available.

Better Be Safe Than Sorry

SAFE THAN SORRY BETTER BE GUIBERSON

THE GUIBERSON CORPORATION

ESTABLISHED 1919
DALLAS, TEXAS
U. S. A.

ONE OF THE DRESSER INDUSTRIES

Sold by Oil Field Supply Stores Everywhere

continue to work with **W. W. Sentell**, manager of the Compressor Sales division, in expanding the market and service facilities for Beaird-Ingersoll-Rand packaged compressor plants. Hendryx, who has been with Beaird since 1951, has worked as both design and sales engineer during his tenure. Previously, he was associated with Texas Eastern Transmission Corporation, Gulf Oil Corporation and Magnolia Pipe Line Company.

Kelly joined Beaird in 1950 as an inspector, moving up to junior engineer, then service engineer before his present promotion.

Marshall C. Hester

J. A. Kappele

James E. Harrington

W. C. Hare

Marshall C. (Slim) Hester has been named to the newly created post of manager of foreign operations for **Southwestern Industrial Electronics Company** of Houston, one of the Dresser Industries. Hester has been active in the electronics field for 12 years. He was employed in the geophysical field for six years before joining SIE in 1952.

•

J. A. (Jerry) Kappele, formerly with **Humble Oil & Refining Company**, has joined his father's firm, **Kappele Engineering Company**, and will head up the firm's Tulsa office. Kappele Engineering is the manufacturer's agent in Oklahoma and Kansas for Gearench Mfg. Company Petol tongs and tools. **M. T. Kappele**, president, will continue to manage the firm and reside in Ponca City, Okla. J. A. Kappele has been with Humble eight years in the Maintenance Engineering department at the company's Baytown refinery.

•

James E. Harrington, Los Angeles attorney, has been appointed general counsel for **McCullough Tool Company**, with headquarters in Los Angeles. Prior to World War II Harrington was chief of the Los Angeles office of the Antitrust division, Justice department, and in that position directed many important investigations and prosecutions in the Los Angeles area involving violations of the Sherman and Clayton Acts. With the advent of the war, Harrington, as a special assistant to the attorney general of the U. S., was placed in charge of the War Frauds Unit of the Criminal division at Los Angeles and personally prosecuted many of the war fraud cases brought by the Justice department in Southern California. During the Korean conflict Harrington served as director of enforcement for the Los Angeles Office of Price Stabilization.

•

Baker Oil Tools, Inc., recently opened a new branch warehouse and office at Patterson, La. **W. C. Hare**, former service engineer at Houma, La., has been appointed branch manager at the new branch.

•

W. A. (Bill) Sammis, Jr., has been named South Texas district manager for **Tex-Tube, Inc.**, of Houston. Sammis has opened a district sales office for Tex-Tube in San Antonio. He had approximately five years experience with the Sheffield Steel Corporation in purchasing and stores and for six years was with the Youngstown Sheet and Tube Company as salesman in Houston and San Antonio.

•

Lloyd Young, office manager, branch and plant accountant for the Oilfield division, **Black, Sivalls & Bryson, Inc.**, has been elected assistant secretary and assistant treasurer. The only fourth generation employe in the history of the company, Young started out with Black, Sivalls & Bryson in 1930 at Bartlesville, Okla., location of the company's original oilfield equipment manufacturing plant. Growing with the company, he rose through the Accounting department to become office manager, as well as plant and branch accountant, in 1950. He continues in that capacity with expanded responsibilities.

ARCCO
ARCCO-Anubis
LIQUID GRAVITOMETER
For PIPELINES, REFINERIES, GASOLINE PLANTS
NOW 19 MODELS
MODEL R
This ruggedly built instrument of laboratory accuracy is ideal for quick checking and for continuous recording of Specific Gravity of liquids under line pressure. Changes in Specific Gravity of sample are recorded with a very minimum of time lag. Foreign liquids and gases are automatically purged from sample. No moving joints or stuffing boxes to cause friction or leakage. Temperature corrected, this precision instrument is adaptable to high pressures. Hundreds are in daily use in plants and refineries of major companies. Available in 19 Models for Recording, Signalling, Transmitting and Controlling. Send for Bulletin 111R-3.
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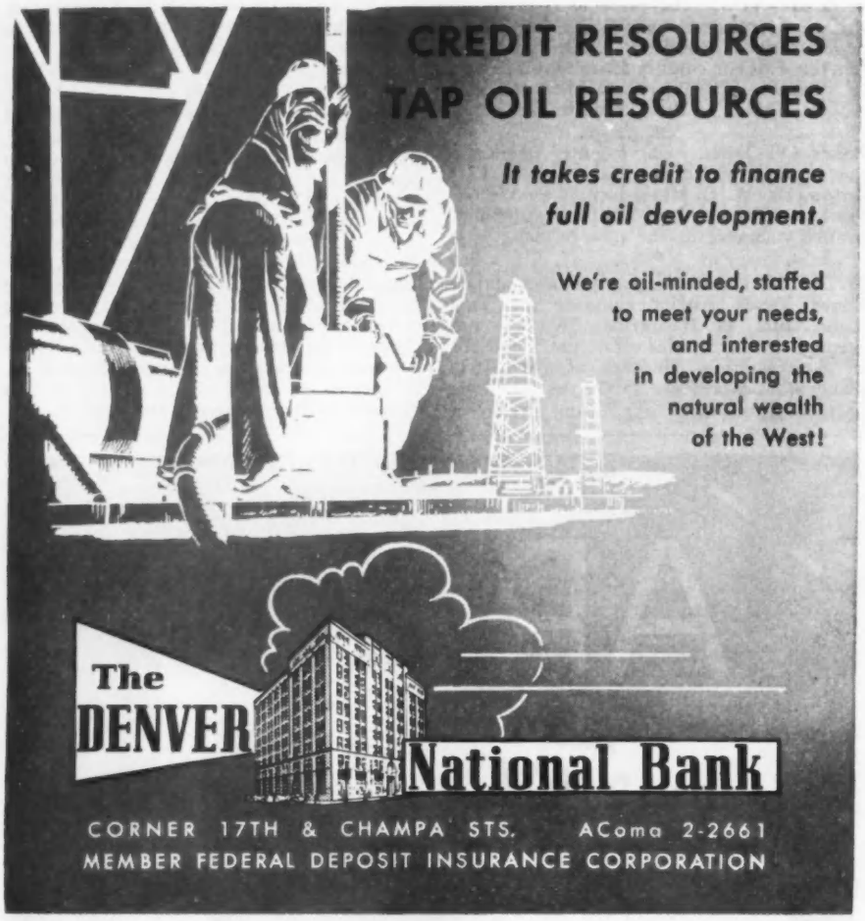
RECORDING CHART CO.
3113 E. 11th St. • Los Angeles 23, Calif.
AVAILABLE FOR EARLY DELIVERY
SEND FOR BULLETIN No. 111-R3


CREDIT RESOURCES
TAP OIL RESOURCES
It takes credit to finance full oil development.
We're oil-minded, staffed to meet your needs, and interested in developing the natural wealth of the West!
The DENVER National Bank
CORNER 17TH & CHAMPA STS. AComa 2-2661
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Relieve the Load on Your Boilers and Save Money with **SAND-BANUM**

Pure Colloidal Concentrate for ALL types of Boilers

Ounces Only Once a Week

REMOVE and PREVENT BOILER SCALE and CORROSION

For ALL Radiator Cooling Systems – Stationary or Mobile

Remove and Prevent Rust and Scale with **SAND-BANUM SPECIAL** in Handy Tablets

SABCO — Rust Preventive Aluminum paint; 2 coats in one application.

RUSTEND — Clear Rust Arrestor—Rust Preventor.

SABANOL — For clean and complete fuel oil burnability.

Stocked by Leading Supply Houses

GULF COAST DISTRICT REPRESENTATIVES

Western Sand-Banum Company, 1717 Chenevert St., Houston, Texas

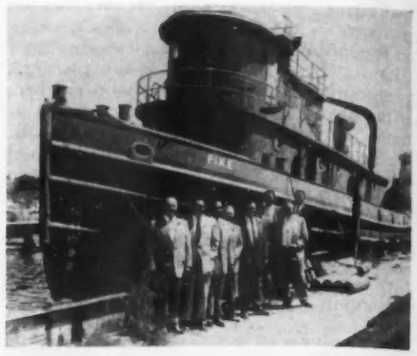
AMERICAN SAND-BANUM CO. INC.

ESTABLISHED 1926

MEADOW BROOK NATIONAL BANK BUILDING

FREEPORT, NEW YORK

SAND BANUM



Pictured left to right beside the "Pike" are R. J. Wales, G & H director, Houston; E. W. McCarthy, president, Gulfport Shipbuilding Corp., Port Arthur; Capt. John Leech, G & H marine director, Houston; J. Newton Rayzor, G & H board chairman, Houston; W. R. Orange, G & H port manager, Galveston; W. D. Haden II, G & H Safety department, Houston; Erie D. Harlan, G & H comptroller and administrator, Galveston; Capt. Robert M. Brower, G & H safety director, Houston; and J. T. Westmoreland, G & H offshore oil industry service representative, Houston.

G & H Towing Launches "Pike" For Offshore Oilfield Service

The "Pike," a 1700 horsepower diesel all-steel tug boat, custom-built for G & H Towing Company, Inc., operating out of Houston, Galveston and Corpus Christi, by Gulfport Shipbuilding Corporation of Port Arthur, Texas, has been christened by G & H officials at Port Arthur.

Designed for the extra heavy-duty requirements of offshore oilfield and deep sea service, the Pike is 105 feet long, with a beam of 27 feet, and a draft of 14 feet when fully loaded with fuel, water and stores.

Fitted with modern navigational and safety equipment, including radar, gyrocompass and Iron-mike, ship-to-shore radio, Fathometer, and the most modern and efficient fire protection system, the Pike will normally carry a crew of eleven but will easily sleep fifteen. The handsomely finished quarters are completely air-conditioned to provide greater comfort to the crew on long hauls in the semi-tropical heat of the Gulf and Caribbean waters.

Homco Opens 11 Outlets In U. S. and Mexico

The Houston Oil Field Material Company, Inc., has opened 11 new outlets in 12 months in various sections of this country and Mexico to facilitate the distribution of its products. In addition, Homco opened a new supply store in Liberty, Texas.

And in Houston the company is erecting a 50 by 100-foot building which will house an enlarged Fishing and Cutting Tool department. Additional machinery is being installed to provide faster delivery of manufactured items.

The new outlets and their type are: Andrews, Texas, supply store; Billings, Mont., representative; Carrizo Springs, Texas, supply store; Hattiesburg, Miss., service tools; Kimball, Neb., supply store; Lafayette, La., supply and service office; Morgan City, La., supply store; New York City, export office; Oklahoma City, Okla., service tools; Sherman, Texas, supply and service tools; Mexico City, export sales.

Unique? Yes!

Because it's a Rheem steel pail. It was made by the world's largest producer of steel containers—RHEEM. That's a lot of experience working for you. As for protection for your product, the linings in Rheem steel pails are bonded directly to the steel and oven baked to prevent flaking and peeling. Rheem pails are available in 1-gallon to 15-gallon sizes; plain, colored or lithographed; lined or unlined; double head or crimp lug type covers. Why not call Rheem today and find out more about sending your products to market—first class—in Rheem steel pails.

YOU CAN RELY ON Rheem MANUFACTURING COMPANY

Leading Producer of Steel Shipping Containers

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WO-12

Texsteam MSM 5001 diaphragm-operated chemical pump

WITH 4 BUILT-IN FEATURES FOR ACCURACY, ECONOMY, EASE OF OPERATION

1. Simplicity of Design—makes repairs by non-technical personnel possible.
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Originally designed for corrosion control work, now also used for Methanol Injection, Hydrostatic Testing, Blending, Evacuation, Dehydration, and many other kinds of work where pressures from 0 to 20,000 psi are required. For corrosive or non-corrosive chemicals.

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DIVISION OF VAPOR HEATING CORP.
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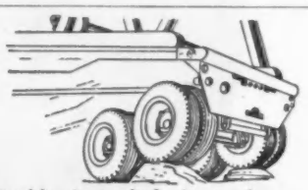
SMOOTH RIDES IN THE ROUGH



Double-pivot shaft in tandem keeps load in balance in rough areas, guarantees load equalization between axles, reduces wear on tires.

Exclusive hi-tensile, pressed-steel frame with angle truss brace permits heavier loads.

Look to Loadcraft for dependability in meeting your oil field transportation requirements. Since the first pole trailer was built 40 years ago by Fred Spencer, trailer manufacturers have attempted to duplicate Spencer quality. Pulls easier because of Spencer True-Beam Axle with machined-in camber, for correct toe-in, maximum tire life. Optional rolling tail pipe for rear loading has self-aligning roller bearings in each end. Find out for yourself that a Spencer Trailer is a quality trailer.

Choose from a complete line of Pole and Pipeline Trailers, as well as tandem or single-axle, semi-floats, or low-beds.

WRITE FOR LITERATURE

Spencer-Safford LOADCRAFT
AUGUSTA, KANSAS

This shows a part of the vast materials storage area for the Alco plant. Materials move from this point into the machine shop or into the heat exchanger assembly area.

Alco Products Completes Beaumont Expansion Program

The completion of a $2 million building and expansion program at its Beaumont plant which will boost substantially production of heat exchangers and oilfield equipment was announced in Beaumont recently by officials of Alco Products, Inc.

The building and expansion program touched all parts of the plant. On recently acquired property north of the original facilities, Alco constructed a 6000-square foot office building backed by a 14,000-square foot warehouse.

The office structure houses executive offices, engineering and development personnel, marketing and general administrative offices.

Alco engineering at Beaumont is under the supervision of M. Wennerbom, Jr., production engineer, and E. F. Cooke, Jr., product development engineer. Wennerbom is concerned chiefly with the design and manufacturing of heat exchangers, while Cooke is in charge of oilfield equipment.

These departments are staffed with project engineers, designers and draftsmen who perform all design work on the company's line of engineered products, including heat transfer equipment.

The modern warehouse is operated in conjunction with the Marketing department and is organized for the immediate shipment of Alco's standard products to the oil industry. These include a full line of parts for the Diesel electric drilling rig power package, Alco's BIW oilfield gate valves, Kinney plug injectors and plugs, Alcotwin fin tube heat exchangers and Alco's large diameter flanges.

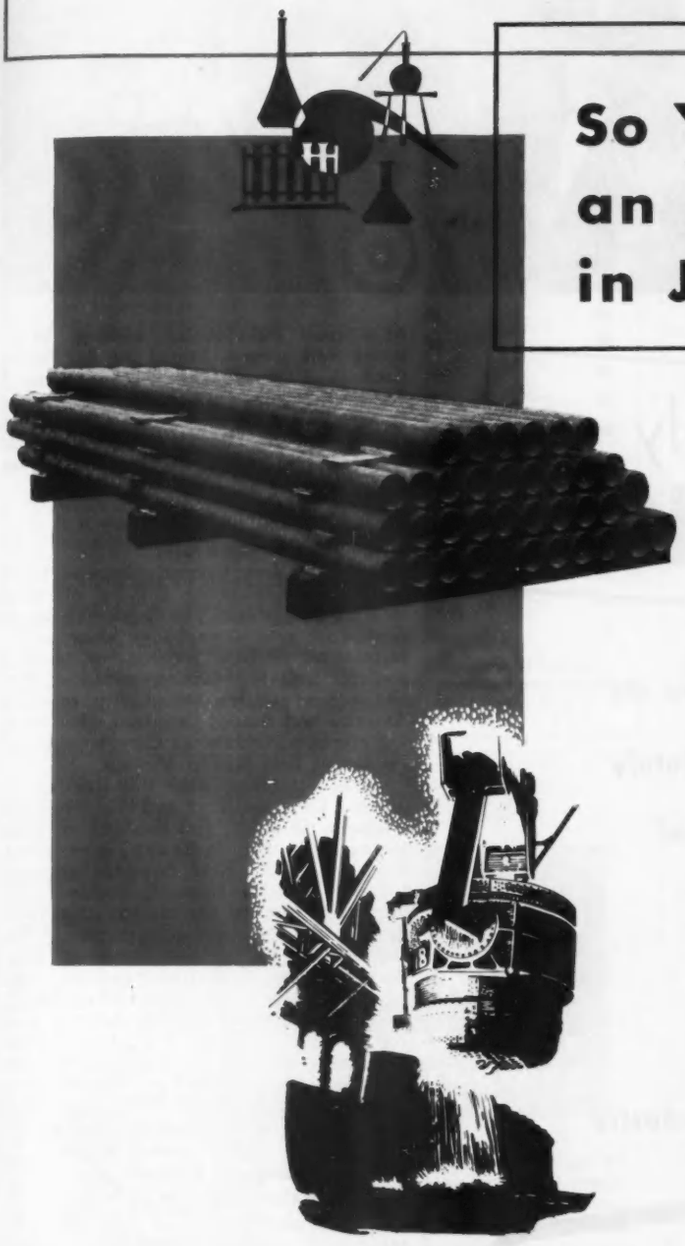
Otis Snubbing Specialists To Move in on Iran Well

Otis Pressure Control has sent one of its pressure control specialists to supervise snubbing operations on the National Iranian Oil Company's 80,000 barrel per day gusher. R. L. (Bob) Green, division superintendent for Otis in Houston, is in Iran, and another Otis snubbing expert will fly over in a few days with the necessary equipment.

The Otis specialists were ordered via cablegram from Drilling and Exploration Company, Los Angeles drilling contractor on the job for National Iranian. The Otis crew is supposed to move in after Myron Kinley gets a master valve made up when the well is brought under control.

The location is a rank wildcat about 325 miles to the east and south of Iraq's field at Kirkuk. The well blew out several weeks ago when the bit broke out of shale

Scarcity Accents the Importance of Quality . . .



So You Have an Important Stake in J&L Research

Every man who buys or uses or is interested in the use of A.P.I. Tubular Products can observe the results of J&L research.

It is reflected in the adaptability and useful life expectancy of every length of J&L pipe, seamless or welded.

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SERVING THE UNITED STATES AND CANADA

3-1

and entered a porous limestone formation at 7800 feet.

Otis is expected to snub in a pack-off overshot so that weighted-up mud can be circulated and the well killed.

Blodgett Named by Axelson To Head Denver District Office

The Axelson Manufacturing Company, division of U. S. Industries, Inc., has established a new district sales office in Denver, Colo., to serve the oil industry.

The new offices under the direction of D. D. Blodgett, sales manager, Rocky Mountain and Canada area is located in the Farmers Union Building in Denver. Prior to his Denver assignment, D. D. Blodgett was Canadian district manager located in Calgary, Alberta, Canada. He has been with the Axelson Manufacturing Company since 1943.

At a recent BrakeSol, Inc., meeting, the following were present. Seated are Bill Ramsey, Cecil C. Blackwell, Jim Boulden, Lester P. Brake, Ken Bowdon, and Frenchie Howard. Standing are Pat Curtin, Al Grimsley, Doug Hall, Buford Cranford, Harvey Lowe, Bill Barton, Jeff Villines, and Tom McNaughton.

BrakeSol Treating Engineers Meet in Oklahoma City

BrakeSol, Inc., recently completed a meeting in Oklahoma City of all of its treating engineers. The purpose of the conference was to exchange ideas and information on new methods of paraffin control. Lester P. Brake, president, gave an account of his recent trip to South America and Buford Cranford, chief treating engineer, Oklahoma City, reported on his recent field trip to Mexico.

Those attending were Bill Ramsey, engineer, Carmi, Ill.; Cecil C. Blackwell, engineer, Houston; Jim Boulden, engineer, Casper; Lester P. Brake, president, BrakeSol, Inc.; Ken Bowdon, engineer, Odessa; Frenchie Howard, engineer, Lovington, N. M.; Pat Curtin, engineer, Oklahoma City; Al Grimsley, engineer, New Iberia, La.; Doug Hall, engineer, Great Bend, Kansas; Buford Cranford, chief treating engineer, Oklahoma City; Harvey Lowe, general manager, Oklahoma City; Bill Barton, sales promotion manager, Oklahoma City; Jeff Villines, engineer, Ardmore, Oklahoma; Tom McNaughton, engineer, Ft. Morgan, Colo.; and Grant Berreth, engineer, Calgary, Canada.

Gulf Oil Company Names Fine Organics Licensee

Fine Organics, Inc., of New York has announced that they have been licensed by Gulf Oil Company to manufacture and sell alkylated phenols, particularly butylated hydroxy toluene (BHT).

Fine Organics will manufacture this chemical in two grades: a technical grade proved to be a powerful anti-oxidant when used as a fuel additive, and a food grade exhibiting superior qualities when used as an anti-oxidant for vegetable fats and treatment of crazy chick disease.

Hycon Signs Mutual Pact To Work With Peruvian Agency

Signing of a mutual representation agreement with the Peruvian Air Force Mapping Agency was made by Hycon Aerial Surveys, Inc., Pasadena, Calif. Under the agreement, mining companies and other firms desiring aerial geophysical survey or photogrammetric mapping

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To establish conclusive proof of the accuracy of our geophysical work, we will, without cost to you, test and record a log of your well on tape, bearing your signature and ours, of your rank wildcat location, in advance of drilling, indicating the existence or not of petroleum in commercial quantities underlying the tested areas and approximately at what depth it may be found. The instruments are entirely self-operating during testing period.

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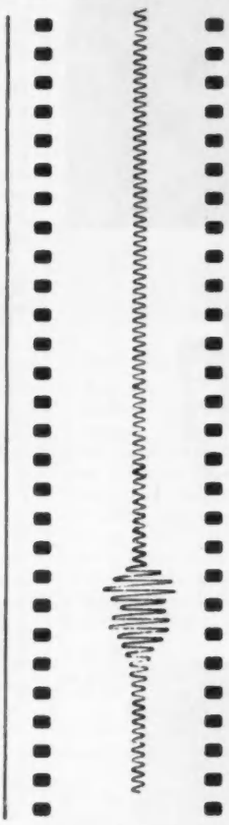

Specimen of log tape indicating saturation with break in zone

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HOLDS PARAFFIN IN SUSPENSION from FORMATION to REFINERY

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GOTKOOL Water Cooler — made in 1½-, 2-, 3-, 5-, 10-, 15-, and 20-gallon sizes with either extended or recessed, flush-mounted faucet. *Note:* 15- and 20-gallon sizes available with extended faucet only.

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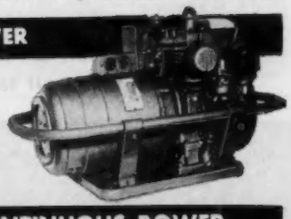

You save time! You save work! . . . because with Katolight Portable Power Plants your crews have just the right plant for the job. Compact, ruggedly built for long life and simple maintenance. Excellent motor starting ability—capacity to handle surge of heavy starting loads. Standard line of gasoline models 350 W. to 50 K.W.

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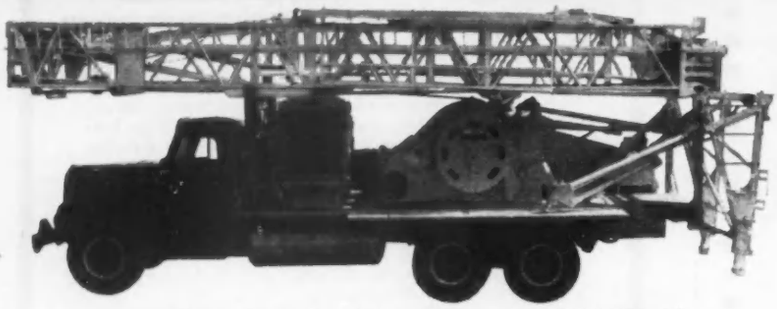
Truck Rambler
WITH GUYLESS KWIK-LIFT MAST AND AIR-CONTROLLED HOIST



Shown above is the M-25-S on International R-190 with independent power unit and KM-65-100 D(H) guyless mast

Faster . . TO THE JOB . . ON THE JOB

Here is the world's most modern and efficient well servicing rig — already field-proved from the Gulf to Canada. Let your Ideco man show you why the Ideco Truck Rambler is setting new standards in equipment of its type.

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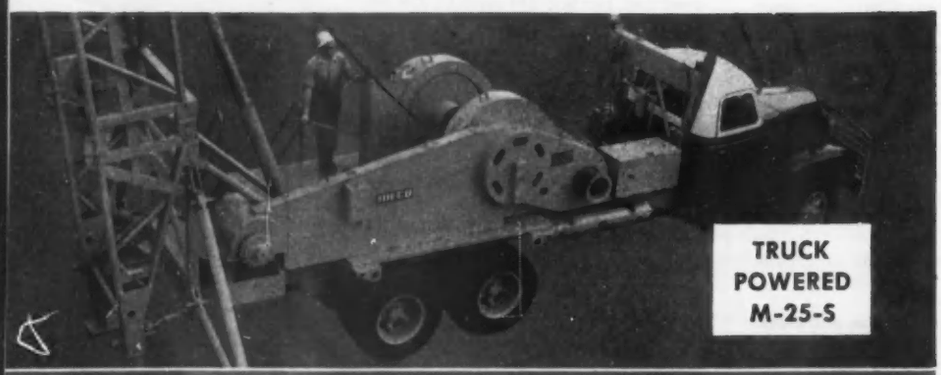
- "Uni-Power" design utilizes truck engine for both propulsion and rig operation through 5-speed mechanical transmission or torque converter.
- Independent power unit on integral skid with hoist also available for truck mounting.

HOISTS:

- Choice of 3 sizes with h.p. input ratings up to 145, 200, and 240. Single or double drum.
- Air controls grouped in single panel at hoist.
- High and low main drum air clutches mounted outside hoist frame for convenient maintenance.
- Precision heavy-duty roller chain on all drives . . . alloy steel sprockets with machined, hardened teeth.
- Heat-treated steel shafts mounted on self-aligning roller bearings; clutch sprockets on ball bearings.

MASTS:

- 65-ft. "D" and "C" or 89-ft. "C" telescoping Kwik-Lift masts . . . Model "D" internally guyed or "C" externally guyed.
- Pole type mast specifications available on request.



TRUCK POWERED M-25-S

When only the best will do . . . Use **IDECO**

ONE OF THE DRESSER INDUSTRIES

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service in Peru will be offered the combined facilities, equipment, and personnel of both Hycon and the government agency.

The Peruvian Agency will also act as Hycon's sales representative in that country. For the first time firms operating in Peru will be able to contract for service with the Varian Nuclear Resonance Magnetometer. This instrument makes magnetic measurements which help to locate deposits of iron and other metal ores often associated with magnetic minerals

Diesel Engine & Equipment To Distribute for Nordberg

Appointment of Diesel Engine & Equipment Service Company as distributor of Power Chief diesel engines in 19 counties in southeastern Texas is announced by Nordberg Manufacturing Company.

Diesel Engine & Equipment Service Company's building has 5000 square feet of floor space and contains offices, a showroom, parts department and a completely equipped shop. In addition, the firm operates four field service trucks and is equipped to provide complete engine repair services in the oil fields.

Ralph Austin is president and general manager of the firm, which was organized in March, 1954. Cecil Brown is vice president and shop manager and Joe Pena is parts manager. The company has 11 mechanics and field personnel.

American Chemical Paint Gets Stock of Benjamin Foster

Acquisition of all outstanding capital stock of the Benjamin Foster Company, Philadelphia, by the American Chemical Paint Company, Ambler, Pa., was announced recently. The Foster Company and its subsidiary, Benjamin Foster Company of Canada, will operate as wholly owned subsidiaries of the American Chemical Paint Company. No personnel changes are planned.

American Chemical Paint Company produces metal working chemicals and agricultural chemicals. The Foster Company specializes in industrial coatings and adhesives for protection of thermal insulation and protective coatings for metal concrete surfaces.

Plans are now being made by management of both companies to supplement and expand Foster's facilities for research, product development, production and sales to enable the company to better serve its market.

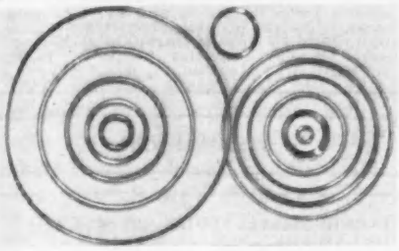
BJ Service, Chemical Process Combine Oil Well Operations

BJ Service, Inc., and Chemical Process Co., of Breckenridge, Texas, have combined their oil well service operations.

The merger of these two 25-year-old oil well service companies was completed under an arrangement whereby all assets of Chemical Process were acquired by the Borg-Warner Corporation. (BJ Service, Inc., is the oil well service organization in the Byron Jackson Division of Borg-Warner.)

Combined facilities of the two service organizations will total 56 field stations and offices, more than 800 units of mobile equipment and approximately 900 service personnel. In addition, two major laboratories at Breckenridge, Texas, and Long Beach, Calif., will coordinate their development projects on oil well service techniques and new service tools and equipment.

Need RING GASKETS?



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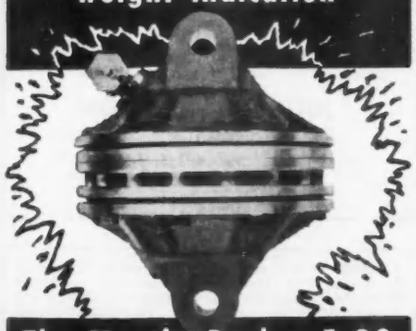

The Martin-Decker E-80 SENSATER

This new kind of diaphragm pressure transformer works with your ideal Wire Line Anchor and transmits direct, no-lag signals to your Martin-Decker Type "D" or "E" Weight Indicator.

The Sensater's amazing mobile diaphragm does not deflect, but moves with its backing plate to give piston-like stroke without a friction-causing piston rod. Positively unaffected by temperature and fluid changes. Write for bulletin P-10.

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HOME OF THE WEIGHT INDICATOR — LONG BEACH, CALIFORNIA

New Tug Joins G & H Fleet

The new 1250 diesel horsepower all-steel tug "Marlin," custom-built for G & H Towing Company, Inc., by Gulfport Shipbuilding Corporation of Port Arthur, Texas, has now joined the offshore oil industry fleet. Fitted out with all of the latest navigational equipment, including radar, gyrocompass and Iron-Mike, ship-to-shore radio, Fathometer, and a modern and efficient fire protection system, the tug is built to the exacting standards of the American Bureau of Shipping, U. S. Coast Guard and U. S. Public Health Service.

100 Plus Heads Gasoline List Of 3 New Cities Service Grades

Cities Service today announced that it is now producing and will market three new grades of gasoline.

The leader will be a new high-octane grade, Cities Service 100 Plus. With an octane rating of more than 100, this aviation-type fuel has been scientifically designed to satisfy the needs of today's high-compression automobile engines, as well as the requirements of cars still on the planning boards.

A stepped-up premium grade, Cities Service Super 5-D, will give increased performance factors and continue to incorporate the five important features that have characterized the gasoline—extra high-octane, anti-carbon, anti-stalling, anti-rust and upper cylinder lubricant.

A new regular-priced gasoline, Cities Service Milemaster, which has been enriched with protective aviation ingredients to improve performance chraacteristics, rounds out the line of fuels announced by Cities Service.

The top grade, Cities Service 100 Plus, will be marketed initially in key areas on the Atlantic Seaboard and in the South.

Oil Center Tool Expands To Offer Quicker Service

New warehouse and office facilities to give quick service to drilling and production areas in West Texas and southern New Mexico have been placed in operation in Odessa by the Oil Center Tool Co. Providing 6000 square feet of floor space, the structure includes complete Christmas Tree testing service.

The company can provide immediate delivery at any time of day or night.

Provided in the new warehouse on West County road north of the Kermit highway are three separate test racks adaptable to any size flange. Warehousemen can assemble and test any size tree up to and including Series 1500, or 10,000-pound test.

This warehouse and office will be the main service point for all West Texas and southern New Mexico. This area includes Abilene and points west in Texas and from Roswell south in New Mexico. A field warehouse also is maintained in Hobbs, N. M.

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■ OIL WELL DRILLING CO. W. Cen. Tex. Terrific buy. $35,243 net 1st 6 mo. '56. Establ. 10 yrs. Loc. in lrg. oil field. Priced right. Low down. Dept. 23739.

OIL TANK SALES. W. Cen. Texas. Xlnt. profits. Well-establ. Top franchise. Many top customers. Illness forces owner to sell. Dept. #23766.

RETAIL AND WHOLESALE OIL, S. C. COHN. Sale of oil, including service to customers. Ideal loc. in com. area. Priced right. Dept. 42230.

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Los Angeles, Cal.

Due to the recent death of one of the owners of Threeway Drilling Company we have decided to sell our rotary drilling rigs. We have two exceedingly well kept Bethlehem drilling rigs fully equipped for drilling in the Permian Basin. If interested please contact Mr. Charles I. Francis, Mellie Esperson Building, Houston, Texas, or Mr. J. K. Hazlip, Box 824, Midland, Texas.

SITUATIONS WANTED

GEOPHYSICIST
German graduate mining engineer and geologist, 17 years experience in drilling, geological and geophysical research. (Seismic reflection and refraction, gravimetric, magnetic and electrical methods.) Worked several years in Middle and Far East and seeks position, preferably outside the United States. Speaks fluent German, English, French. Inquiries to Box 118-W, WORLD OIL, Houston.

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INCORPORATE YOUR BUSINESS IN DELAWARE. New or old. Charter cost little. Do business anywhere. Quickest! Cheapest! Write for free Folder—5W. Faultless Organization, 684 N. Sangamon St., Chicago, Ill. List of 65 Underwriters and Brokers that handle NEW corporation issues. 100 Oil Security Dealers. Both lists $5. Millions of Classified Investors names. Neatly typed.

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140 Acres
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80,000 sq. feet
44,000 sq. ft. under roof, 36,000 sq. ft. open, 390 sq. ft. on railroad track. Excellent location. Only four blocks from business district. Just off main Highway. Will make attractive sale or lease price. Write or phone for details.
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185,000 ACRE RANCH Southwest Texas in Presidio and Brewster counties, 36 miles Rio Grande river frontage, 81,100 acres State mineral classified, leaving around 140,000 mineral acres . . . 600 miles sheep proof fence, wonderful improvements includes 7 houses, one almost a mansion, 10 line camps, 40 windmills, 150 miles water pipe lines, railroad loading pen on ranch, black tail deer, javelinas, and blue quail. Has been very dry past few years has run 45,000 sheep and goats, has $4.50 acre loan can be brought with very little cash per acre . . . ask for pictures . . . Landing strip.
3,000 acres 40 miles north of Del Rio, Texas, ½ minerals, has $50,000 home completely furnished and good landing strip, in deer country . . . can lease ranch and reserve use of house and hunting privileges . . . can be bought at a bargain.
Both these ranches have been in drouthy condition sveral years **now** is time to buy.
R. C. JONES REAL ESTATE
P. O. Box 3155—Phone 6457
San Angelo, Texas
For phone information on big ranch call E. F. King, Broker, Marfa, Texas, phone #92.

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HELP WANTED

Opportunities

for

Geophysical Personnel

Due to our steady growth as a seismograph contractor with extensive inland as well as off-shore operations we need Seismologists, Junior Seismologists, Chief Computers, Observers and Junior Observers. This is your chance to grow with a well established, progressive company. Salary commensurate with experience and ability. Contact:

Marine Exploration Company

5115 Westheimer, Houston, Texas

P. O. Box 1129, Oil Center Sta., Lafayette, La.

5150 Desire, New Orleans, La.

HELP WANTED

■ ENGINEERING OPPORTUNITY. Wanted: A graduate Engineer who has had oil field and sales experience. Must be willing to spend good portion of time in travel. Headquarters in Houston. Address Box 116-W WORLD OIL.

■ OUTFITTING SEISMIC PARTY for Libya. European seismic party chief. Minimum of eight years experience. Also need seismic computer, seismic observer, surveyor, shot hole drillers. Must speak English fluently. Please write stating qualifications, availability, salary desired. Send small snapshot. Write Box No. 115-W WORLD OIL.

Foreign Jobs Open

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Major Oil Companies, Contractors, Independents Throughout the World.

All types of qualified personnel needed. Toolpushers: Production Foremen, Drilling Engineers, Geologists, Operation Managers, Diesel Power Rig Mechanics, Refinery Specialist. All types.

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Houston, Texas

LEASES

North Chaves County, N. M.

One field recommended already important discovery. Other major area to drill. Lease or Royalty interests at low cost in either field offer great potential value. Data on request.

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Exploration 1918-1956 **Engineering**
Portales **New Mexico**

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■ RIG FOR SALE. Complete Workover Rig—Capable of Drilling to 8500'—Unit 15 Draw-works—2 NKU Engines—126' Lee C. Moore Mast—15' Substructure—27 x 14 Mud Pumps—2 Water Pumps—25 KW Kohler Light Plants—26" Series 900 QRC Cameron B. O. P.—In good condition and ready to go—For details write to P. O. Box 161, Opelousas, La.

GRADE A USED PIPE FOR SALE

4" 14.98# P.E. line pipe 4700'
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Clinton Iron and Metal Company
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NOW AVAILABLE

10" (10¾" O.D.)
GOOD USED RECESSED
LINE PIPE COUPLINGS

Limited Quantity
First Come—First Served
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PRospect 6-1808 (Day)
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St. Louis Missouri

PROJECTS ENGINEERS

Ambitious and energetic young Mechanical Engineers interested in design and research work on valves, fittings and associated products. Should have B.S.M.E. from good school plus three to ten years experience in a line related to the oil field. Excellent benefits and wonderful suburban location in a rapidly growing industrial area. This is your opportunity to grow with the oil industry's fastest growing company. Salary from $7,200 to $9,000 depending on experience and ability. In first letter please furnish complete resume, transcript of college credits and recent photo if available. Write Box 117-W World Oil, Houston, Texas.

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IMMEDIATELY AVAILABLE

QUAN.	BBL. CAP.	QUAN.	BBL. CAP.
1	100,000	18	1,800
7	80,000	2	1,750
10	55,000	4	1,500
3	20,000	6	1,000
12	10,000	2	650
10	5,000	2	500
1	2,500	1	420

Heat & Power Co., Inc.

P. O. BOX 587 DRUMRIGHT, OKLA.
PHONE: Drumright 569

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$50.00

(Less than cost to make)

ROUNTREE MACHINERY CO.

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FOR SALE

SLIM HOLE CASING

20,000' 3½" OD 7.70# 10RD THRD T&C
40,000' 4½" OD 9.5# 8RD THRD T&C
27,000' 4½" OD 11.00# 8RD THRD T&C
5½", 7", 9⅝" OD CASING ALSO AVAILABLE.
25,000' 2⅜" OD 4.7# NEW SMLS RANGE 2 EUE 8RD THRD
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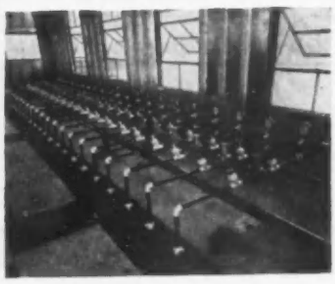
PRODUCTION ENGINEERING
SERVICE, INCLUDING
CORE ANALYSIS

PRESSURE MAINTENANCE WITH GAS OR WATER

CENTRALIZED INJECTION METERING



Strawn Sand
Water Flood
Wichita County
Texas

REPRESSURING WITH GAS OR WATER

SURVEYS
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PETROLEUM ENGINEERS
CABLE ENGINEERING
WICHITA FALLS, TEXAS

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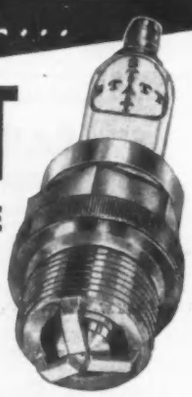
uses . . .

STITT
NEW TRIPLE IGNITOR
SPARK PLUGS

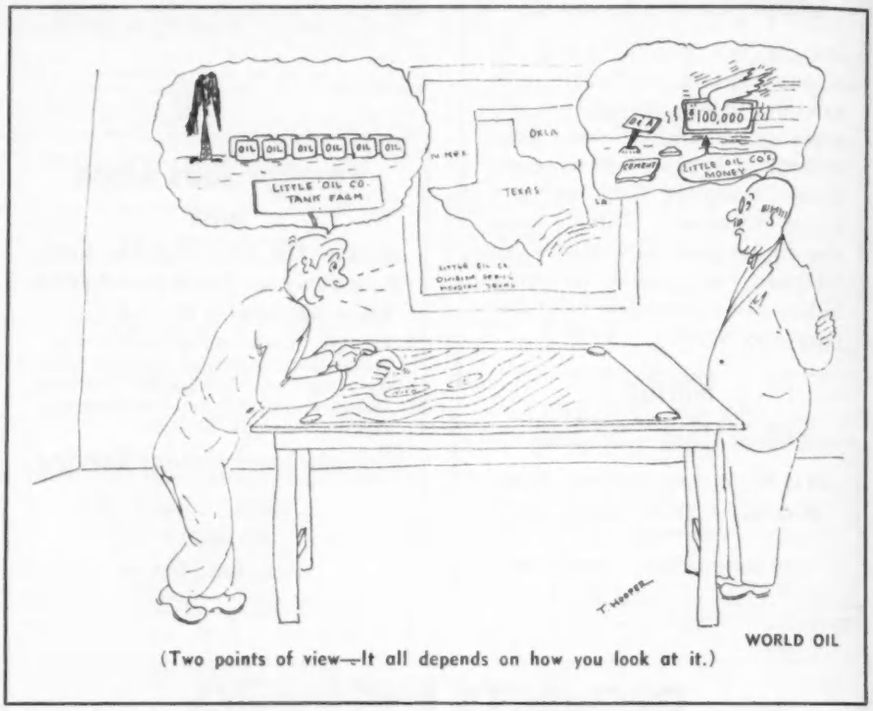


. . . to get peak performance longer, Cooper-Bessemer is now factory-installing STITT New Triple Ignitor Spark Plugs. STITTS last up to 10 times longer, cut downtime, increase magneto life. Also factory equipment in other leading oil field engines.

Write today for FREE Pocket Catalog giving recommended plugs for all your engines—help you get better plug performance.

STITT IGNITION CO.
COLUMBUS 1, OHIO
STITT MAKES HEAVY-DUTY, INDUSTRIAL-TYPE PLUGS!

SQUEAKS from the BULLWHEEL



WORLD OIL

(Two points of view—It all depends on how you look at it.)

Traffic

Traffic is getting tougher. A weary commuter wired his boss: "Will not be at office today. Am not home yesterday yet."

Terrific Day!

First Salesman: "Say, Jim, I had a marvelous day; made lots of friends for the company."

Second Salesman: "Me, too. I didn't sell anything either."

Not All At Once

The girl had just said yes.

"Do your folks know that I write poetry?" he asked.

"Not yet, dear," she said. "I've told them about your drinking and gambling, but I couldn't tell them everything at once."

It's All the Same

"My husband is an efficiency expert for a large company."

"Just what does an efficiency expert do?"

"Well, if we women did it, it would be called nagging."

Remember Me?

John was feeling very ill. He staggered off to find a doctor. At last a sign caught his eye: "J. M. Jones, M.D. First visit, $5, subsequent visits, $3."

Into the office John went with outstretched hand, "Well, well, Doctor Jones, here I am again."

More Specific

Employer to a beautiful blonde who has just filled in a job application: "Miss Jones, under 'experience,' can you be a little more specific than just 'Oh Boy!' "

But Daddy

"Daddy, why can't I go out and play like the other kids?"

"Shut up and deal."

Bad to Worse

The inquisitive chap stared at the name on the shop window—A. Swindler.

He went inside and asked, "Wouldn't it be better if you printed your first name in full?

"Hardly," said the merchant. "My name is Adam."

Something Wrong

The inmate had his ear pressed up against the wall.

"Listen!" he whispered.

The new attendant listened intently, then finally confessed: "I don't hear a thing."

"I know," the inmate said darkly. "It's been like that all day."

Do-It-Yourself Saloon

Since you cannot refrain from drinking, why not start a saloon in your own home? Be your only customer and you'll not have to buy a license. Give your wife $55 to buy a case of cheap whiskey. There are 240 snorts in a case. Buy all your drinks from your wife at 60 cents a snort and in 12 days when the case is gone, your wife will have $89 to put in the bank and $55 to start in business again.

If you live ten years, and die in your boots with the shakes, and have bought all your booze from your wife, she will

have $27,085.37 on deposit; enough to bury you respectfully, bring up your children, pay off the mortgage on the house, marry a decent man and forget she ever knew you.

Incongruity

Why is it that most girls will scream at the sight of a mouse and then deliberately climb into a convertible with a wolf?

Training

Wife: "Darling, how did you get Junior to eat olives?"

Husband: "Simple, I started him with martinis."

Non-Believer

The teacher asked Billy why Noah took two of each animal on the Ark. To which Billy replied, "Probably because he wasn't one of those squares who believed in storks."

No Driver

A drunk boarded a two-decker Fifth Avenue bus and slowly ascended the spiral stairway to the top. He had been up there only a short while when he scrambled downstairs and took another seat near the front.

"Don't you like it upstairs?" asked the driver. "It's really much cooler."

The drunk gulped several times in a heroic effort to speak.

"Spose it's cooler. But it ain't safe. There's no driver up there."

But Happy

While being interviewed for a local newspaper, the horse trainer frankly confessed that just before the big race he had given his nag a big shot of whiskey.

"Did he win?" he was asked.

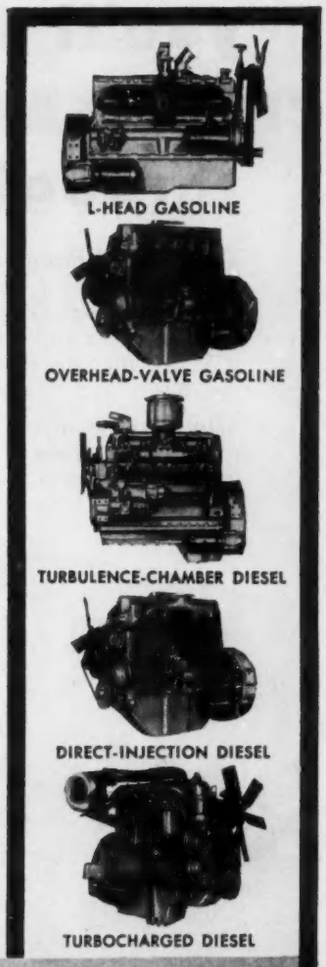
"Nope," said the trainer, "but he was the happiest horse in the race."

Long Voyage

An enterprising sailor offered to smuggle a young woman to Hawaii and hid her in a lifeboat. After several days and nights passed, with the sailor spending all his spare time with the girl, she began to wonder why they didn't arrive at their destination.

Finally, she went to the captain of the

This is HERCULES MOTORS Today



DEPENDABLE POWER FOR INDUSTRY

Yes, this is Hercules Motors, today—all types of dependable power for modern industry. The Hercules line includes more than 90 different models of engines and complete power units ranging from 3 to 500 H.P.

An ever-growing list of customers are solving their power problems with these types of Hercules Engines: L-head gasoline, overhead-valve gasoline, natural gas, L.P.G., turbulence-chamber diesels, direct-injection diesels, Turbo-Charged Diesels, marine diesels and complete open, closed and base type power units.

Write for more information on any of these dependable power plants. Our sales-engineers will be happy to help solve your power problems. No obligations, of course.

HERCULES MOTORS CORP.

Engine Specialists Since 1915 • Canton, Ohio

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

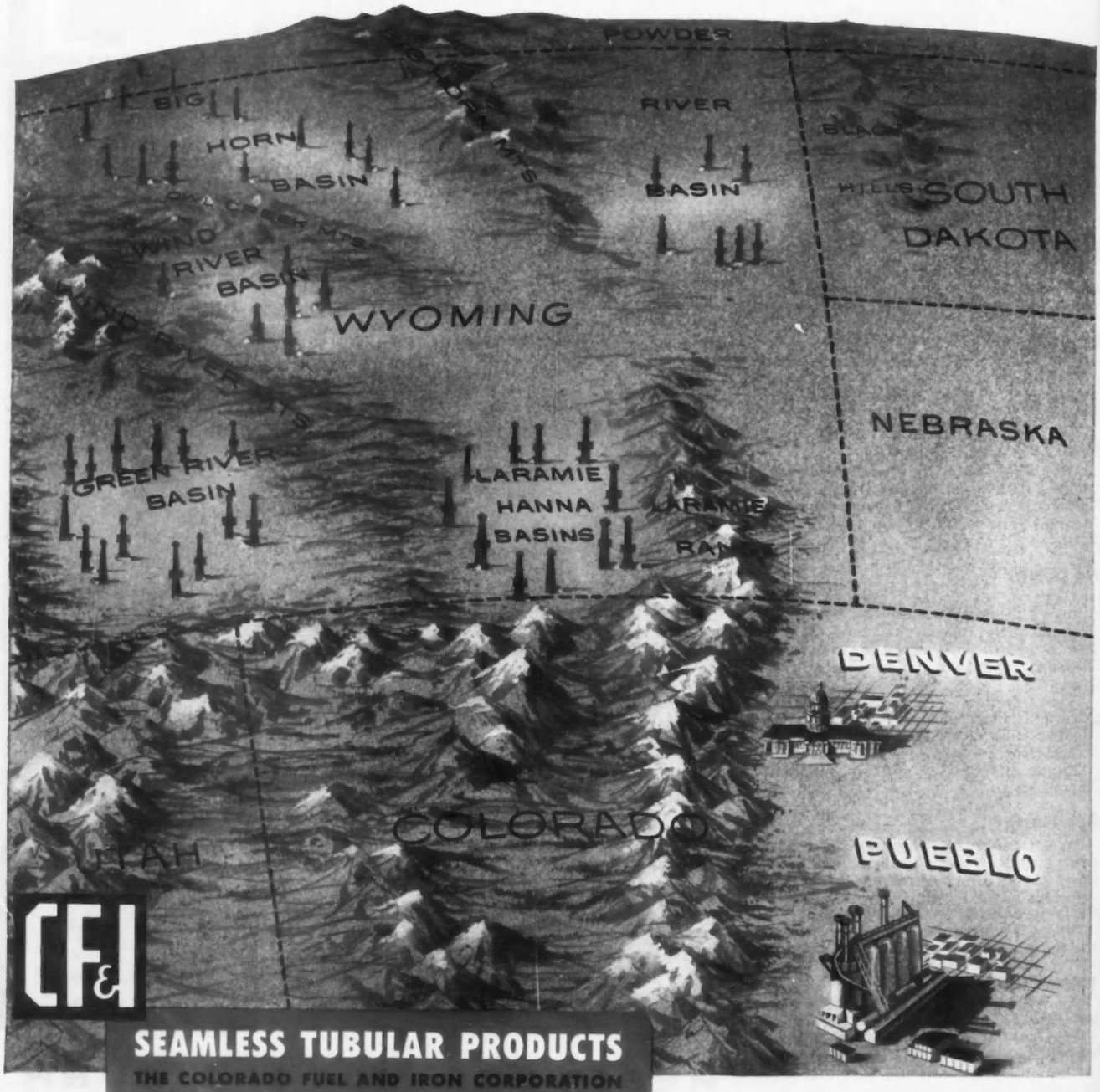
you'll find

CF&I SEAMLESS CASING AND TUBING throughout the Wyoming basins

Today, CF&I Seamless Oil Country Casing and Tubing is serving operators throughout Wyoming's Big Horn, Green River, Laramie-Hanna, Powder River and Wind River Basins—just as it is serving other oil field operators all over the West.

Why such popularity? The answer is *quality*—quality that assures each operator that CF&I's conveniently located Seamless Tube Mill offers them casing and tubing manufactured for maximum service.

It will pay you to specify *CF&I* Seamless Oil Country Casing and Tubing. Available in 2⅜" through 9⅝" O.D., this dependable product meets or exceeds API STD 5A specification. See your CF&I representative today for complete details.



WORLD OIL

I heard we were operating on a shoestring lately, but I didn't think . . .

boat, confessed and told him the whole story. Then she asked: "When will we get to Honolulu?"

"Lady," the captain said, "this is the Seattle-Bremerton ferry."

Just in Case

They had just become engaged and she was full of plans for their future life. "And just think, dear," she gurgled, "I shall always be there to share your troubles."

"But, darling," he protested, "I don't have any troubles."

"Oh, I know," she replied. "But I was talking about after we're married."

Close Call

A mousy little man was frightened silly of his boss. One day he told a fellow worker he was sick. His friend suggested he go home.

"Oh, I couldn't do that."

"Why not?"

"The boss would fire me."

"Don't be silly. He'll never know. He's not even here today."

Finally the man was convinced and went home. When he got there he looked in the window and saw his boss kissing his wife. So he ran all the way back to the office.

"A fine friend you are!" he said to his co-worker. "I nearly got caught."

Don't Rush

The sweet young thing signalled a taxicab and said to the driver. "To the maternity hospital, and never mind rushing. I only work there."

Only Once

Once there was a lion tamer who said that his father before him had also been a lion tamer.

"Did you ever put your head in a lion's mouth?" he was asked.

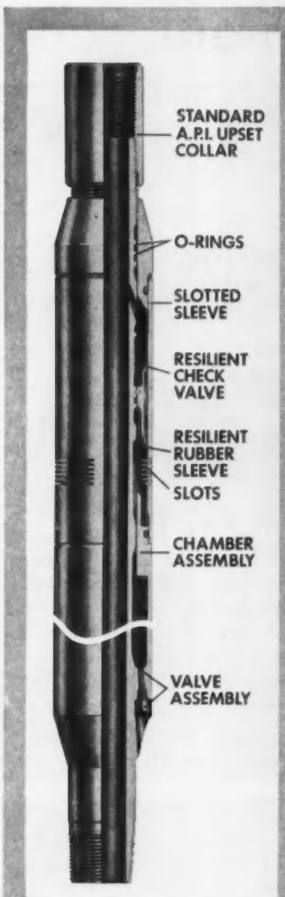
"Only once," said the fellow, "to look for dad."

Speed Course

"In teaching shorthand and typewriting we make a great point of accuracy," the head of the business college explained.

"And how about the speed?" asked the prospective student.

The college head thought a moment. "Well, out of last year's class, sixteen married their employers within three months."



The operating principle of the Type C Otis Gas Lift Valve is so completely different from conventional gas lift equipment that it makes available certain production practices that heretofore have not been possible for wells on gas lift.

Remarkably simple in design and construction, Type C valves can be used for continuous or intermittent flow, they can be used in dual completions, they are adaptable to permanently-completed wells, they can be adapted for casing flow, and certain sizes can be installed without pulling tubing.

A resilient rubber sleeve is the only moving part, and extremely small opening and closing differentials are possible, even with sand-laden fluids. The valve is built *around* a full-opening mandrel (rather than alongside the tubing) which affords greater strength than the tubing itself. The check seals positively and does not require velocity to close. When used in an intermittent operation, a minimum amount of gas is required to lift the load of fluid, regardless of surface choke settings or long flow lines.

The Type C Otis Gas Lift Valve has so many significant advantages that we believe it has advanced gas lift technology by at least ten years. Ask an Otis man why.

OTIS

OTIS PRESSURE CONTROL, INC.

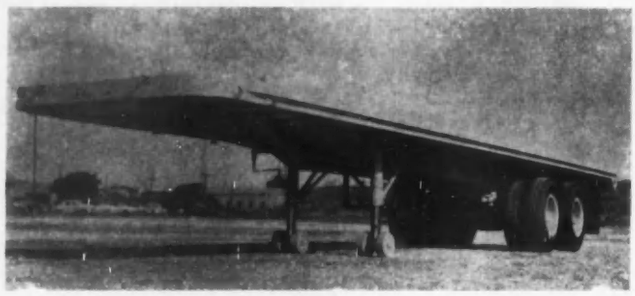
Gas Lift Division: 2402 Broad Street, Houston

Branches Throughout the Oil Country

What's New In Equipment

Drilling • Production • Exploration

Heavy-Duty Trailer

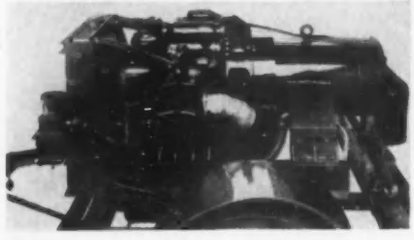


A new heavy-duty platform trailer, rugged enough for handling concentrated loads off the highway, yet light enough for moving profitable, legal payloads along the road, has been introduced by Hobbs Trailers.

Designed to bridge the equipment gap between off-highway and over-the-road assignments for oil field haulers and other movers of heavy materials, the new light-heavyweight of Hobbs' K-series platform trailers is produced in lengths from 33 to 41 feet. It is reported that although it has a rated capacity of 45,000 pounds, it weighs only 10,849 pounds.

The new trailer's centerframe is a 12-inch I-beam of high tensile steel. Crossmembers are stronger, closer together and the center section of the unit is further strengthened by eight knee-braces between the center frame and the outer frame rail, four to a side. Other features of the light-heavyweight include a folding kingpin (for use with a two or three axle truck) and a two-speed landing gear.

For more data, circle **No. E1** on Reader's Service Card, last page this issue.



Microwave Generator

Witte Engine Works announces the new model 100RDA for microwave installations. This unit is designed to produce 12,000 watts continuously, 24 hours a day. A heavy-duty, industrial-type generator is directly connected to an 18 horsepower water-cooled diesel engine. The engine is designed with horizontally-opposed cylinders. The effective balance that is achieved by this design assures a smooth operating unit.

This horizontal, balanced design makes possible an extremely strong unit with a low profile (approximately 30 inches high), so that it is suitable for all types of installations, particularly where space must be conserved. It is possible to operate the engine-generator set without fastening means. All parts are designed for long life, and easy accessibility. The unit is simple to operate and requires a minimum of servicing.

Approximate overall dimensions are: length, 65 inches; height, 30 inches; and width, 39 inches. Weight is 1700 pounds. The engine is a Witte Series 100 (100.5 cubic inches displacement). It has a 4-inch bore and a 4-inch stroke and drives the generator at 1800 revolutions per minute. Higher speed of 2400 rpm is permissible in special engine applications. An inherently regulated, 3-phase, 60-cycle generator is normally furnished. It is complete with a direct-connected exciter. A generator can also be furnished with separate voltage regulation, radio-suppression equipment and otherwise in accordance with the Armed Forces' requirements.

Design and maintenance features of the engine include: wet-type replaceable cylinder liners, precision-type aluminum bearings, replaceable valve guides and valve inserts, dynamically balanced crankshaft and full-pressure lubrication.

(This item supplements Witte Engine Works data on pages 5297-5304 of the Composite Catalog, 21st Edition.)

For more data, circle **No. E2** on Reader's Service Card, last page this issue.

Portable Pipe Line Coupler

The first industrial coupler for portable aluminum pipe lines that will withstand working pressures up to 1000 pounds per square inch, and is available both in OD and IPS pipe sizes, has been developed by the John Bean Division of Food Machinery and Chemical Corporation, San Jose, Calif.

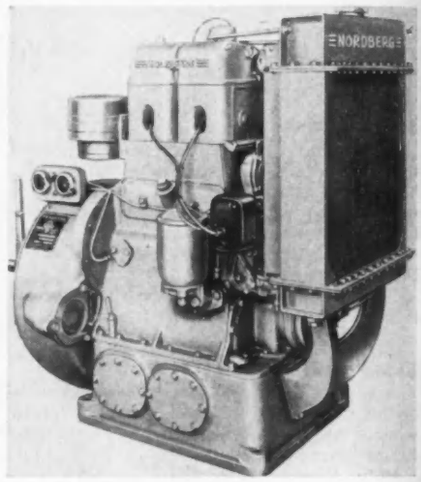
Other advantages of the new FMC fast move coupler are its heavy breach-acting jaws that secure the coupler with a quarter turn, the lock screw that spins up in an instant and locks the coupler against untwisting through line torque and the exposure of no metal part of the coupler to the material within the line. A special aromatic resistant Buna-N gasket is placed so that there is almost no disturbance of flow to create friction losses. The gasket is pressure sealing.

The new FMC coupler can take rough treatment. There are no threads on the body of the coupler to become damaged or clogged with dirt. There are no loose parts to be lost. The coupler protects the ends of the pipes from damage. A corrosion-resistant alloy is used that is compatible with the pipe material; it is heat treated for strength.

In addition to being used in the petroleum, construction and mining industries, FMC coupler pipe lines are expected to be used for the transmission of corrosive or abrasive materials, as well as sticky liquids and semi-solids, since the lines can easily be dismantled and cleaned.

(This item supplements Food Machinery & Chemical Corp. data on pages 5081-5104 of the Composite Catalog, 21st Edition.)

For more data, circle **No. E3** on Reader's Service Card, last page this issue.



Two-Cylinder Gas Engine

Addition of a two-cylinder gas engine to its Power Chief series of small diesel and gas prime movers is announced by Nordberg Manufacturing Company. Now in production, Model 4FG2 extends the horsepower range of Nordberg's Power Chief gas engines for oil field pumping service.

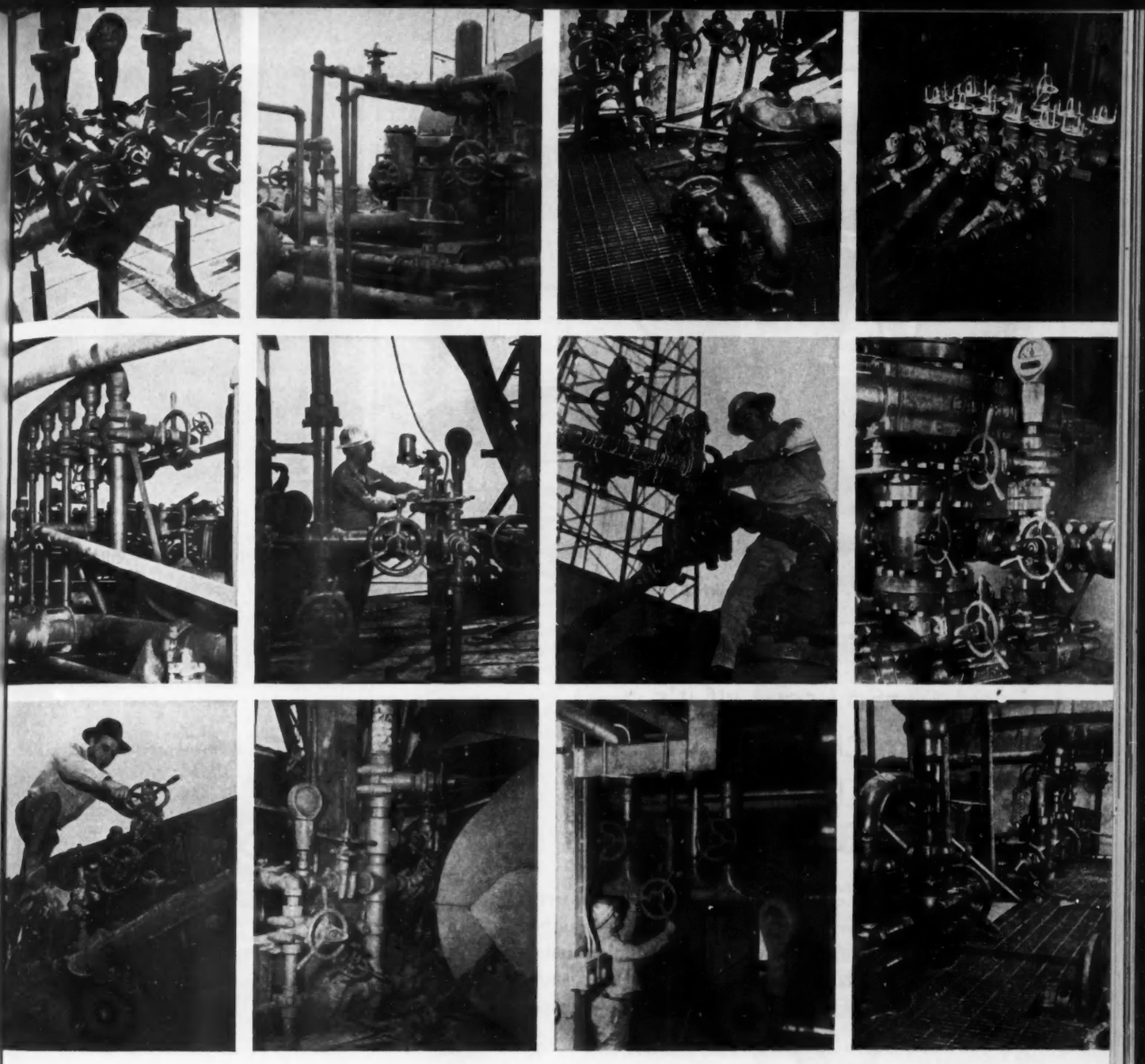
This new model has an API rating of 12-24 horsepower at 800-1800 rpm. It is equipped with a combination gas-gasoline carburetor and a gas pressure regulator. Safety shut-down controls for low oil pressure/high water temperature also are standard equipment. Additional safety features are an enclosed clutch, enclosed flywheel and an enclosed fan.

With a bore of 4½ inches and a 5¼-inch stroke, this four-cycle engine has a piston displacement of 167 cubic inches. Compression ratio is 6:1. Radiator is large enough to assure trouble-free operation at ambient temperatures up to 125° F.

For more data, circle **No. E4** on Reader's Service Card, last page this issue.

Wire Rope Clips

Canton Manufacturing, Canton, Ohio, specialists in holding and binding products, have added wire rope clips to their line. A complete range of sizes are available for wire rope diameters from ⅛ inch up to 1½ inch, 16 sizes in all. They are offered in a plain self-colored finish, cad-



There is one best Mud Valve . . . FLEX-SEAL

proven a million times or more!

You would naturally expect the people who have had most experience with resilient seals to come up with the best practical solution to the mud valve problem. That is just what Cameron did, years ago.

Drawing on a vast backlog of experience with resilient seals for blowout preventers, master drilling valves, and wild well capping manifolds, Cameron engineers perfected the Flex-Seal Valve for mud lines. It was accepted immediately, and mud manifold maintenance the world over took a nose dive.

The reason? No other valve is quite as rugged. No other valve may be relied upon to operate freely and seal tightly after long and severe service. No other valve may be repaired at such low cost.

The Flex-Seal Mud Line Valve was not designed for obsolescence. Someday, if a better mud line valve is built, it will come from Cameron . . . specialist in producing equipment for the control of well pressures and drilling costs!

Cameron

IRON WORKS, INC.

P. O. Box 1212 - Houston, Texas

Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd., Time & Life Bldg., New Bond Street, London W. 1 England.

"So I says, 'If it's a Christmas Tree... I'll decorate it...'"

The naive young man may not know a Christmas tree from a Christmas tree . . . but here's something you can bet on: veteran Joe Roughneck, symbolic figure of the fabulous oil industry, knows everything about everything concerned with drilling for and producing oil . . . including pipe.

Whether Joe is rendering rugged service on a rig . . or whether he's the brain of a big company . . he knows the kind of quality pipe it takes. More, he knows Lone Star makes it . . and will deliver it on the double! Depend on Lone Star API casing, tubing, and line pipe.

Neighbor, wherever you are,
MERRY CHRISTMAS!

Lone Star STEEL COMPANY

LSS

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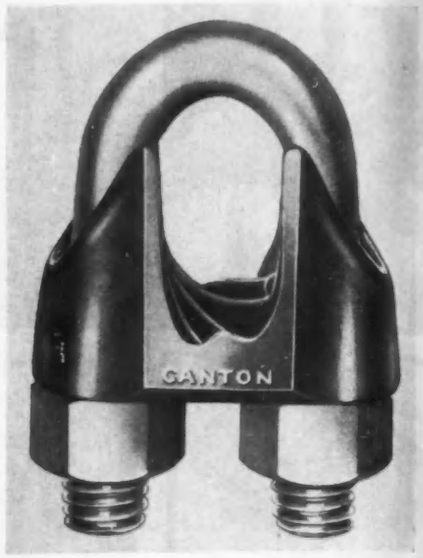


mium plated or hot dip galvanized. The U-bolt portion is heavy steel with malleable saddle shaped to fit wire rope strands giving maximum grip.

The Canton clips are packaged in easy to handle heavy card-stock boxes or bulk-packed.

For more data, circle **No. E5** on Reader's Service Card, last page this issue.

DC Rectifier Welder

A new rectifier welder with "diverter path" control was announced by Hobart Brothers Company, Troy, Ohio.

New case design permits easy to remove side panels. The recessed control panel has polarity reversing switch, three coarse current adjustments with rheostat control for fine current adjustments. The rheostat can be removed for remote control. The welder has both thermostatic and current overload protection. A magnetic line contactor is supplied at no extra cost.

The unit is available in 300 and 400 ampere models.

For more data, circle **No. E6** on Reader's Service Card, last page this issue.

Pipe Corrosion Prevention

Here's an economical way to guard pipe and tubing against costly internal corrosion during storage. Protokap, Inc., is now offering slip-over and roll-on end caps made of neoprene that effectively seal out air, moisture, corrosive fumes, dust and small animals.

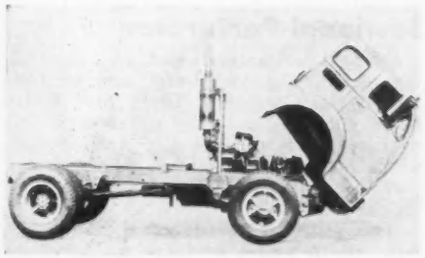
By simply adding a small amount of dehydrating agent before slipping on the easily fitted caps, the inside of expensive alloy tube stock is protected from corrosion. Ideal, too, for threaded pipe, the new caps retard drying of thread dope and keep the threads free of sand and grit.

Two types are currently available: a lightweight roll-on cap for pipe 2 to 10 inches in diameter; and a heavier, slip-on cap for 2- to 20-inch diameter piping. The standard slip-on covers have a wall thickness of about ⅛ inch.

The new end caps are made of rugged Du Pont neoprene and will stand up to rough handling and repeated re-use. Unlike ordinary rubber, neoprene also is highly resistant to oil, acids and other chemicals, sunlight, and weather.

While the new caps were designed primarily for stored piping, they are equally effective for protecting heat exchanger tube bundles, well casing, and various other tubular goods for oil field and refinery applications.

For more data, circle **No. E7** on Reader's Service Card, last page this issue.



White Turbodiesel

The White 3000 Tubodiesel, introduced by The White Motor Company, provides maximum payloads with the power-lift cab where heavy front axle loadings are important factors.

Continuing the White 3000 design in principle, the new White 3000 Turbodiesel introduces a cab four inches higher than previous 3000 models and affords better safety and visibility for the driver. Longer, resilient front springs and direct, double acting shock absorbers, plus the White 3000 weight distribution, result in improved riding comfort. Other driving advantages are the wide track front axles, shorter wheelbase and short turning radius for better maneuverability.

For more data, circle **No. E8** on Reader's Service Card, last page this issue.

High Grade Lubricants

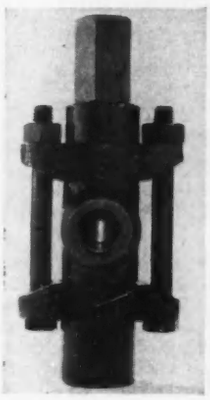
A new and improved gear lubricant was announced by Lubrication Engineers, Inc., of Fort Worth. These new products, 509 and 510 multi-purpose gear lubricants, were developed to offset new problems of gear lubrication which have been brought about because of higher torque and pressure values which major equipment manufacturers have incorporated into most modern day equipment.

Preliminary field tests indicate that the high anti-wear properties of 509 and 510 multi-purpose gear lubricants will substantially reduce excessive wear of pinion and ring gears. Further, Lubrication Engineers expects to reduce gear lubricant consumption in some instances as much as 400 percent with these new products.

For more data, circle **No. E9** on Reader's Service Card, last page this issue.

Safety Relief Valve

A safety relief valve designed to withstand pressures up to 10,000 pounds per square inch has been introduced by the Fluid Mechanics division of Protek Specialty Company. For its size, the valve has a high capacity of liquid flow at 25 percent over pressure. It handles air, gas or liquid and has been fully proved under severe field test conditions.



The new valve has close blow down control on expansible gases and vapors. It is ideal for all systems handling crude oil, sour gas and oil vapors, including hydraulic control systems, high-pressure gas systems, and high pressure separators.

The valve body is an extra heavy carbon steel casting. The stainless steel inner valve parts are so constructed and assembled there is no stress around the seating area, thus assuring a leak-tight seal after long periods of operation. Narrow, 45-degree seats offer less resistance to flow, and less surface area to catch abrasive matter.

The Fluid Mechanic valve is made in ½, ¾, and 1¼-inch sizes It can be furnished in all stainless steel or other alloys for petrochemical service The company also makes valves and hydraulic flow equipment to meet the special requirements of original equipment manufacturers, as well as a complete line of combination pressure-vacuum relief valves for low pressure tank service.

For more data, circle **No. E10** on Reader's Service Card, last page this issue.

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Composite Catalog, Page 3369

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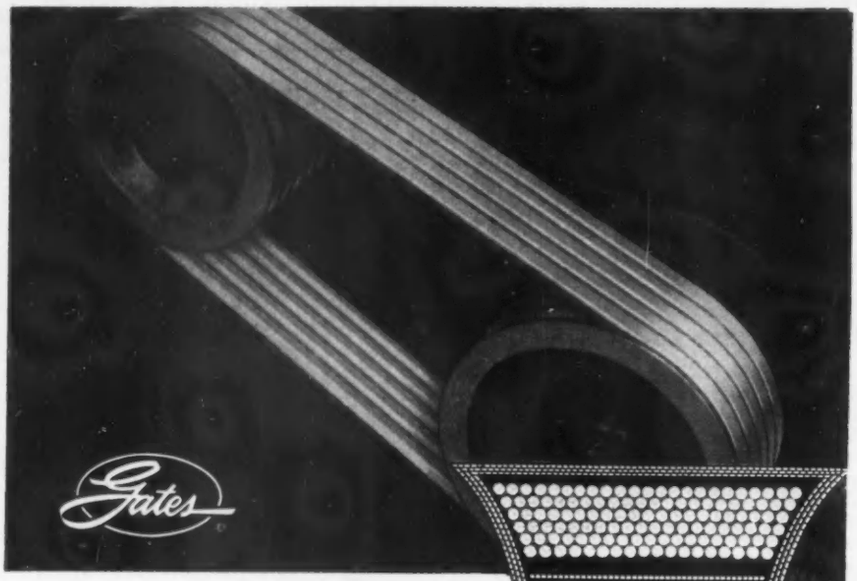
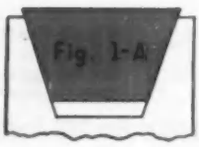


Concave sides make V-belts last longer

The sides of every Gates V-belt (Fig. 1) are concave—a precisely engineered curve that greatly increases V-belt life. Here's why:



On the bend around the sheave, the concave sides of a Gates V-belt fill out and become straight (Fig. 1-A). Thus the belt makes full contact with the sides of the sheave, grips the sheave evenly, and wear is distributed evenly across the sides of the belt. Uniform wear lengthens belt life; keeps costs down.

Make this simple test

Take a straight-sided belt (Fig. 2) and bend it. Feel the sides at the bend; they bulge out. Now picture this bulge in the sheave groove (Fig. 2-A). It is easy to see that the belt makes uneven contact at points indicated by arrows. Naturally, wear is greater at these points. Uneven wear shortens belt life; increases belt costs.

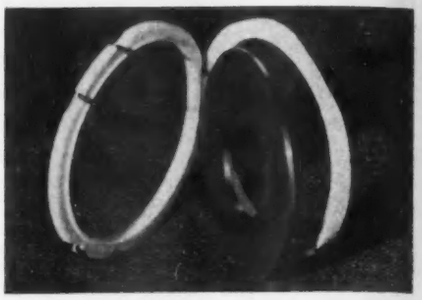
Cut down-time and V-belt replacement costs. Specify belts that grip evenly and wear longer . . . specify Gates Vulco Rope—the V-belt with concave sides. There is a Gates distributor nearby who will quickly supply the belts you need. The Gates Rubber Co., Denver, Colorado

—World's Largest Maker of V-Belts

TPA 86

Gates VULCO ROPE Drives

PRODUCTION



Teflon Sealing Unit

Daniel Orifice Fitting Company has developed a new Orifice Plate sealing unit from Teflon. Designed for use in Daniel senior and junior fittings and simplex plate holders, this seal unit gives perfect seal on both orifice plate and fitting seat. Patented annular groove allows contraction and expansion, maintaining continuous perfect seal. Soft texture eliminates scratches caused by metal to metal contact.

The new TS seal is a simple, two-piece unit that locks securely around the orifice plate with ring clips, and is recessed to receive Daniel Catalog 500 orifice plate. The plate can be removed by hand pressure alone—no tools required.

Extensive field tests have proved Daniel TS Unit Seals effectively under conditions previously considered too severe for efficient sealing action. TS units have a temperature range of minus 65° to plus 500° F., and are especially recommended for wet, corrosive, dry or high pressure service. (Its self-lubricating features makes it particularly good in dry service.)

It is available from stock in sizes 2 inch through 12 inch and comes as standard unit on 900, 1500 and 2500 lb. ASA Daniel fittings. Also available for simplex orifice plate holders and lower pressure fittings at additional cost. Photo shows new Teflon unit in open position with Daniel Catalog 500 orifice plate in approximate position of insertion. Note simple design showing locking rings.

(This item supplements Daniel Orifice Fittings Co. data on pages 1381-1416 of the Composite Catalog, 21st Edition.)

For more data, circle **No. E11** on Reader's Service Card, last page this issue.

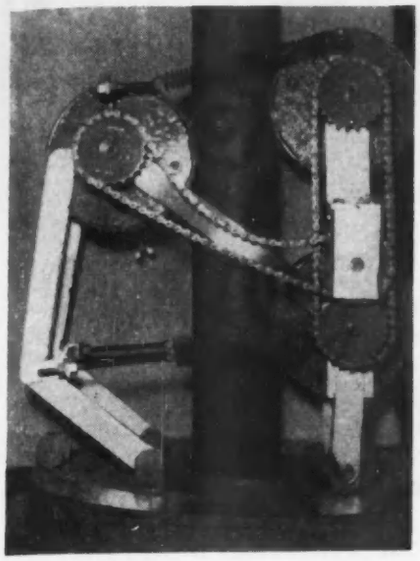
Sectional Perforator

Oil well perforators which are assembled to order at the well were introduced by Lane-Wells Company. These new Kwik-Kone guns are radically different in appearance, composed of flat steel sections which bolt together to form shaped-charge carriers of practically any length required for the job.

This sectional, bolt-together assembly is reported to make for increased speed on the rig, and for easiest possible set-up for varying shot densities as required, since the carrier can be assembled and loaded on the job. With a 50-foot gun, as many as 200 shots are possible on one run, to handle long zones in brief time.

(This item supplements Lane-Wells Co. data on pages 2837-2856 of the Composite Catalog, 21st Edition.)

For more data, circle **No. E12** on Reader's Service Card, last page this issue.



Automatic Pipe Strapper

The Drilprodco Stripper Strapper has been invented and perfected by Drilprodco, Inc. This tool will eliminate the trouble and time of strapping the drill pipe with a tape line. It is more accurate than strapping with a tape line.

The Stripper Strapper is mounted on a stripper rubber, which is mounted in a cage on top of the flow-nipple. The stripper rubber turns within this cage which permits the drill pipe to be rotated while coming out of the hole.

There are three rollers synchronized together so that one roller cannot roll without the other two turning. There will be only one roller coming in contact with a tool joint or drill protector at a time, leaving two rollers on the drill pipe, so there will be two rollers running against one. This will eliminate all slippage.

For more data, circle **No. E13** on Reader's Service Card, last page this issue.

Shale Drilling Mud

A new mud which improves drilling fluid performance in troublesome shale formations is now offered by Magnet Cove Barium Corporation. Called T-8 Mud, it offers many outstanding advantages in addition to hole stabilization and inhibited shale hydration.

The new mud can be used wherever lime mud is currently employed, and, besides being more efficient than lime, T-8 also is exceptionally effective for penetration of the troublesome shale zones.

T-8 offers a number of advantages over conventional mud types.

1. T-8 mud cost is lower.
2. It is easy to control.
3. Hole stability is greater.
4. It is safer to use.
5. Improved electric logs result.
6. Production is improved.

The mud is prepared using T-8 compound as the conversion and primary maintenance chemical and creates a mud system that is in a state of "controlled dispersion" when operated within the proper chemical limits. T-8 compound is a complete mud chemical treatment, and under most conditions it is all that is needed to properly maintain the chemistry of a T-8 Mud. The mud has been used in deep wells with very good results and it has been successful in drilling in gouge zones around salt domes where operators previously had difficulty drilling.

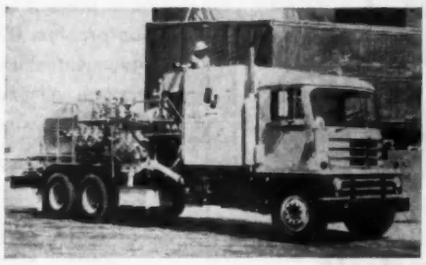
(This item supplements Magnet Cove Barium Corp. data on pages 3094-3095 of the Composite Catalog, 21st Edition.)

For more data, circle **No. E14** on Reader's Service Card, last page this issue.

Cab-over Cementing Unit

BJ Service, Inc. has introduced a new high volume, high pressure cementing and pumping unit in a cab-over design. Rated at 510 horsepower, this model 111TA unit is capable of mixing and pumping 425 gallons of cement per minute. In addition, this unit employs a completely new cab-over design which gives (1) additional deck space, (2) better arrangement of displacement tanks and triplex pump, and (3) better arrangement of the mixing pump through the use of an inline drive with a torque converter, an improvement over the previous counter-shaft arrangement.

This 111TA unit developed for services requiring pressures up to 8000 pounds per square inch uses a Diamond T chassis with a 335 hp engine and carries a newly designed Gardner-Denver PA-8K triplex pump 4½ by 8 with 8000 lbs. working



pressure and a Gardner-Denver FC-VXXU pump 4½ by 8 with 3000 lbs. working pressure. Power for the high pressure pump is furnished from the 335 hp truck engine through a 10-speed transmission, special power take-off and drive lines. A 175 hp engine on the deck at the rear of the unit supplies power to the low pressure pump through a torque converter and two-speed transmission.

This unit is equipped with a jet type mixer which is supplied with water from the low pressure pump. A 200 cubic foot two-compartment displacement tank, each compartment holding 100 cubic feet of fluid, is mounted behind the truck cab.

The suction manifold design permits drawing of fluid from either or both tank compartments to either or both pumps individually or simultaneously. The new efficient alloy high pressure discharge manifold permits discharging of fluid to the well from both pumps through one discharge line. Individual discharge lines are also provided, enabling the operator to displace fluid and pressurize the well annulus simultaneously.

(This item supplements BJ Service, Inc., subsidiary of Borg-Warner Corporation data on pages 1061-1066 of the Composite Catalog, 21st Edition.)

For more data, circle **No. E15** on Reader's Service Card, last page this issue.

PERFORATE TUBING IN THE WELL

KINLEY TUBING PERFORATOR

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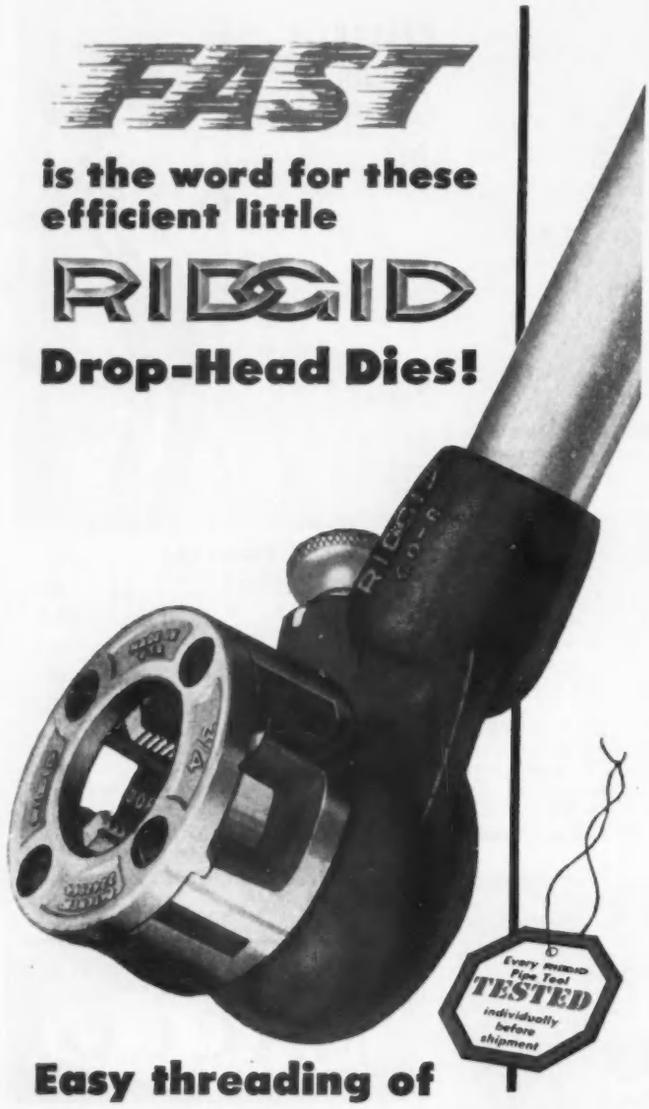

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Snap size head you want into ratchet drive ring, from either side—it can't fall out. Dies reverse easily for close-to-wall threading. 00R and 0R, ⅛" to 1"; 111R and 11R, ⅛" to 1¼"; 12R, ⅛" to 2". Free carrier with sets. Conduit and special dies available. Real work-savers—at your Supply House!

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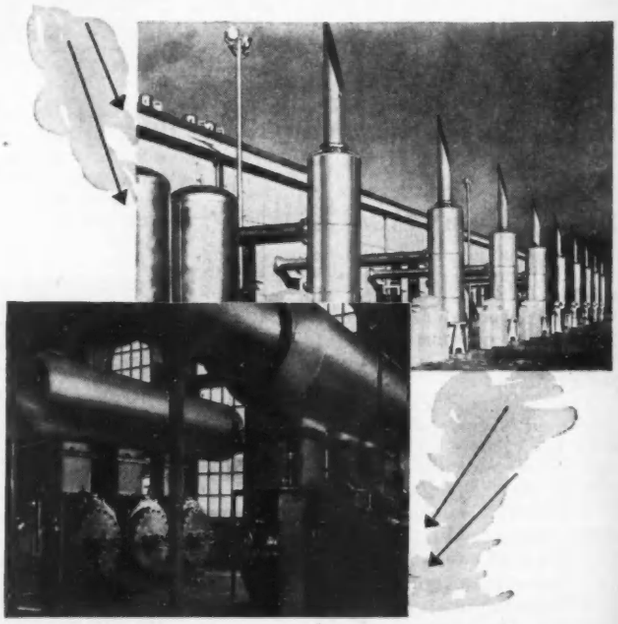

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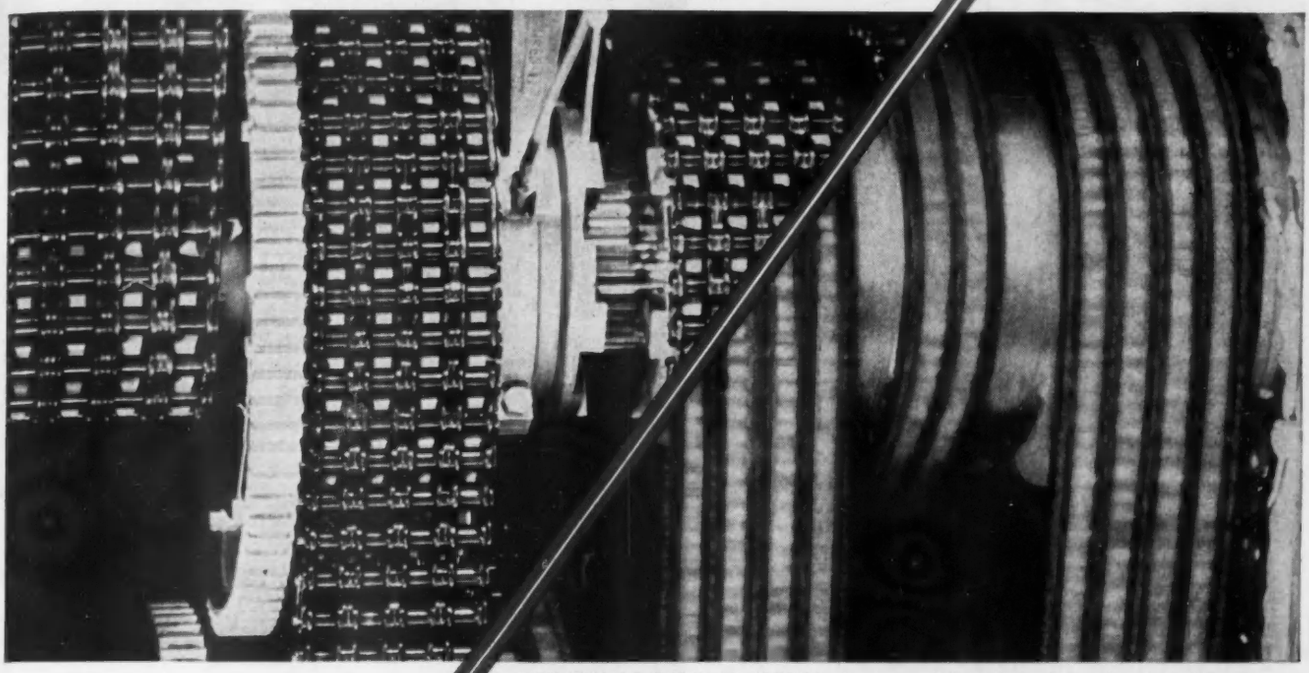
RESISTANCE TO TENSILE STRESS is achieved by use of properly heat-treated, accurately-machined sidebars made of premium steel and fitted with properly-hardened pins, bushings and rollers. But to resist *operational* stresses, additional controls over dimensional accuracy, uniformity and roller resiliency are essential.



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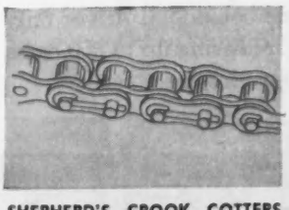

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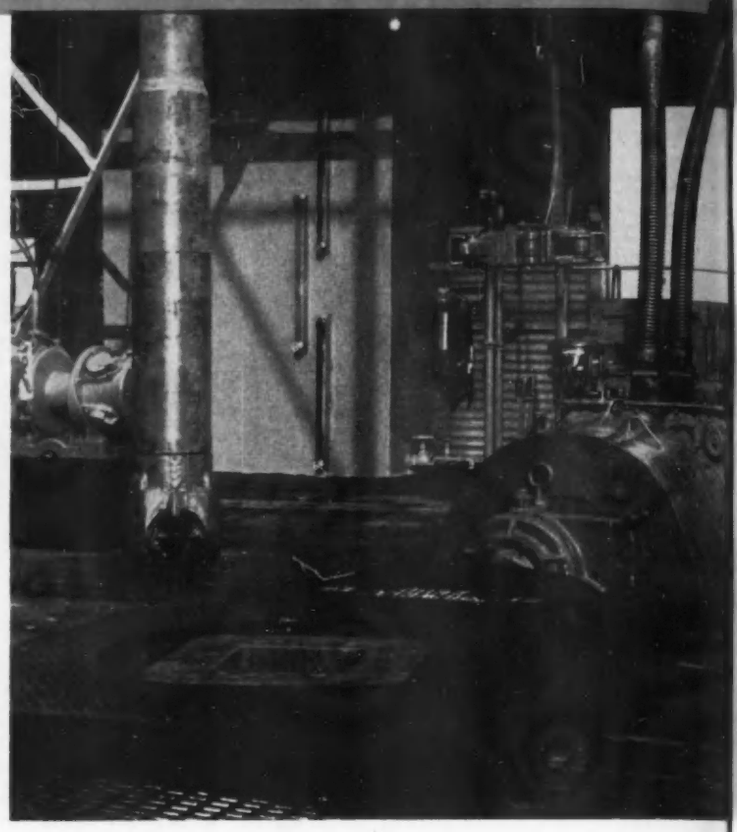

PHOTO SHOWS an "Oilwell" Universal Drilling Unit with 26-HD Rotary, powered by a twin engine, on a drilling barge for off-shore operations. Transmission provides two forward and one reverse speed.

If you are thinking of directional, off-shore drilling operations, consider the advantages of having your rotary independently driven by an "Oilwell" Universal Drilling Unit.

With the hydraulic torque converter between the engine and the rotary, the danger of bit "twist-off" is reduced, should the drill string bind or stick. The hydraulic torque converter permits a nearly constant engine speed and provides a two-way cushioning effect against shock. Protection from "twist-off" increases in importance as the drill string curves toward the horizontal.

In all types of drilling . . .

An "Oilwell" Universal Drilling Unit relieves wear and tear on the draw works and adds to its service life because the draw works transmission system is not used to run the rotary and does not operate while rotating on bottom. In addition, the engine compound drives only the slush pumps while drilling, releasing up to 200 extra horsepower for jet-bit or deep-well operations.

Our Universal Drilling Unit, with single throttle control, permits the driller to regulate precisely the drilling speed and torque over a wide range to suit particular drilling conditions. And during servicing or in an emergency, the rotary can be quickly and easily disconnected from the drilling unit and driven from the draw works in the conventional manner.

Your nearest "Oilwell" store or representative will give you complete information about the "Oilwell" Universal Drilling Unit.

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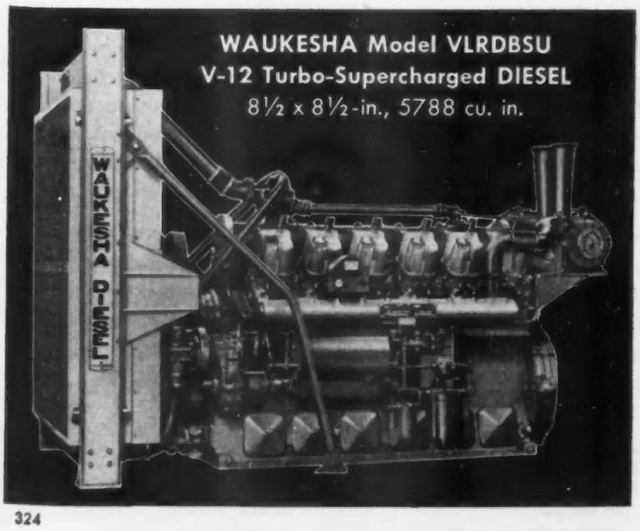

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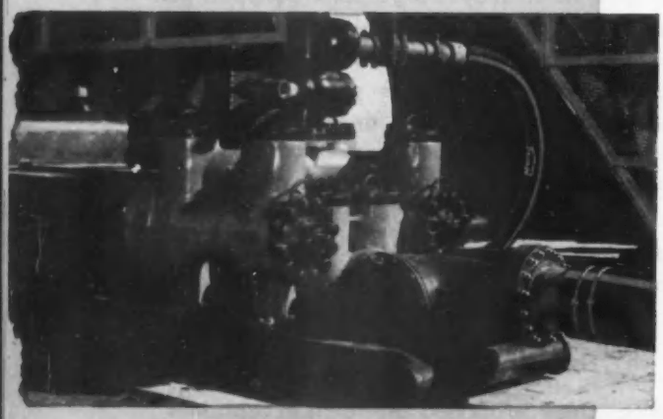
Get Thermoid Oilfield Products at your nearest "Oilwell" Store

Powerflex Pressure Seal Rotary Hose, with patented forged steel couplings, combines light weight with great strength.



Mud-Flo Suction and Flexible Discharge Hose cuts down on rig-up time and reduces vibration in the mud lines.

THERMOID HOSE is made by patented and exclusive construction methods for each type of oilfield service . . . and is designed with extraordinary strength to withstand the high-pressure and pulsation stresses that are peculiar to drilling applications. That's why "Oilwell" stocks and recommends Thermoid products.

THERMOID POWERFLEX ROTARY HOSE . . . is a rugged combination of high-tensile steel cable, heavy-duty fabric and oil-resistant synthetic rubber; bonded together to produce a tough, abrasion-resistant hose that is unrivaled for strength and flexibility. Full-flow steel couplings are securely anchored. Each length is proof tested to 5000 lbs.

THERMOID TRIOFLEX ROTARY HOSE . . . for slim-hole drilling, is reinforced with high-tensile steel wire braid. This hose is extremely flexible and resistant to kinking and coils in 36″ diameter. The tube is constructed of highest quality synthetic rubber, with a tough oil and grease-resistant cover that protects the inner sections from wear. Each length is proof tested to 2000 lbs.

THERMOID MUD-FLO SUCTION HOSE . . . is made with thick oil-resistant inner tube firmly bonded to strong cotton fabric. Heavy galvanized round wire reinforcement is embedded in rubber compound to absorb pumping vibrations and provide unobstructed flow.

THERMOID FLEXIBLE DISCHARGE HOSE . . . incorporates the same rugged construction features as Powerflex Rotary Hose and acts as a flexible high pressure connection between the mud pump and the standpipe. It eliminates many sharp-angle fittings and reduces turbulence and pressure loss.

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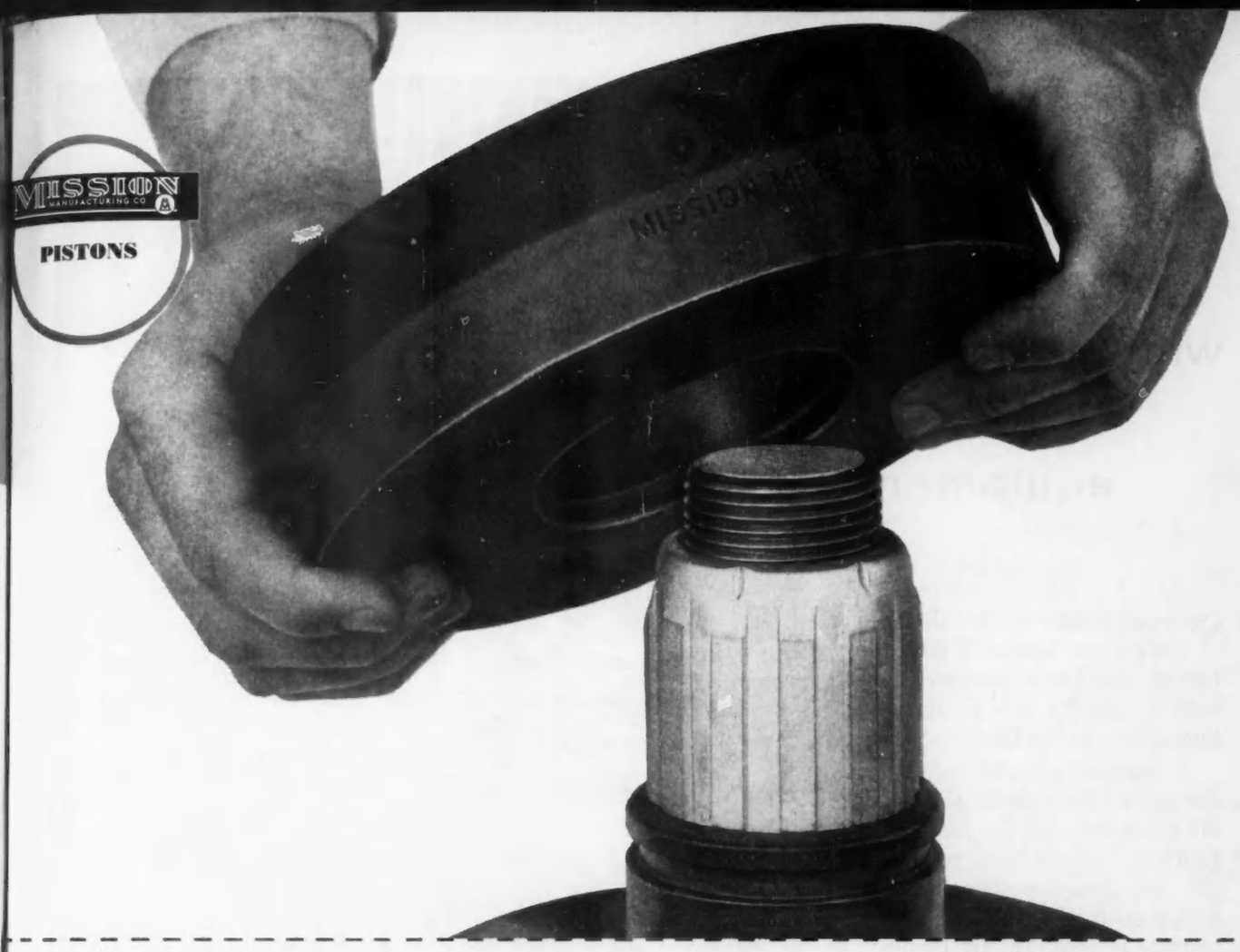

This rubber is one of the main reasons Mission Pistons give such outstanding service. It has enabled Mission Pistons to win competitive tests against all other pistons on the market.

Development testing at Mission is a continuous process and is your assurance that Mission Pistons are the best obtainable. We guarantee them to be the most economical on the market. Buy with confidence. Your supply store has them in stock.

Nothing but the finest will bear the name of MISSION MANUFACTURING CO.

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Speeds drilling under water with **DENISON** hydraulic equipment

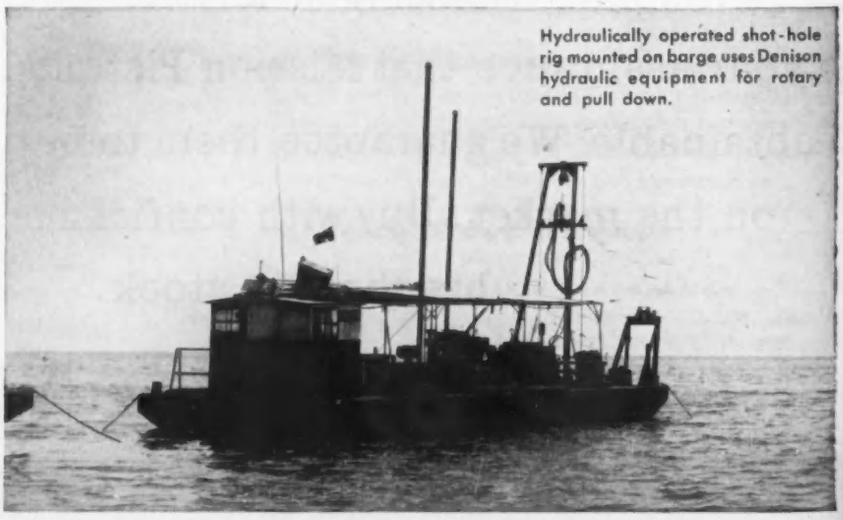
SIXTEEN HOLES—90-feet deep—in only eight hours. That's the footage this barge-mounted shot-hole rig drills using Denison Pump/Motors and Denison Valves.

A Denison Pump/Motor powers the hydraulic system for this major oil company rig. Two additional Denison Pump/Motors rotate the drill and control pull-down of the rotary table. Accurate, fingertip control is provided by Denison hydraulic valves.

The hydraulically operated marine rig drills faster . . . is more dependable, easier to maintain than mechanically driven rigs.

Since the shot-hole crew paces the exploratory drilling team, it will pay you to take advantage of Denison's experience in hydraulics to speed drilling on land or under water. Write to:

Driller controls winch and drill pipe with Denison hydraulic 4-way Valves. Hydraulic power is supplied by the Denison Pump/Motor located under the tank.



Hydraulically operated shot-hole rig mounted on barge uses Denison hydraulic equipment for rotary and pull down.

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Designed and engineered to stand up under hard usage with minimum upkeep.

One of few unit lines available with anti-friction bearings throughout.

Precision-cut gears (not lapped) permit partial replacement in the field when necessary. High hardness gear material stands up under hard wear.

Quick, safe adjustment of counterbalances at ground level by one man. Emsco counterbalances may be adjusted to lead or lag the load as required.

Complete accessories, ground-level lubrication, guards, skid extensions, slide rails and modern brake.

Extra rigid gear case allows precision gears to operate as designed.

No oil seals to wear out in reducer.

Four-legged Samson post is extremely rigid.

Two sumps for oil to drop out emulsions or particles.

There's an Emsco Pumping Unit for every type of well. Send for two colorful new bulletins or see your nearest Continental or D+B store for complete information.

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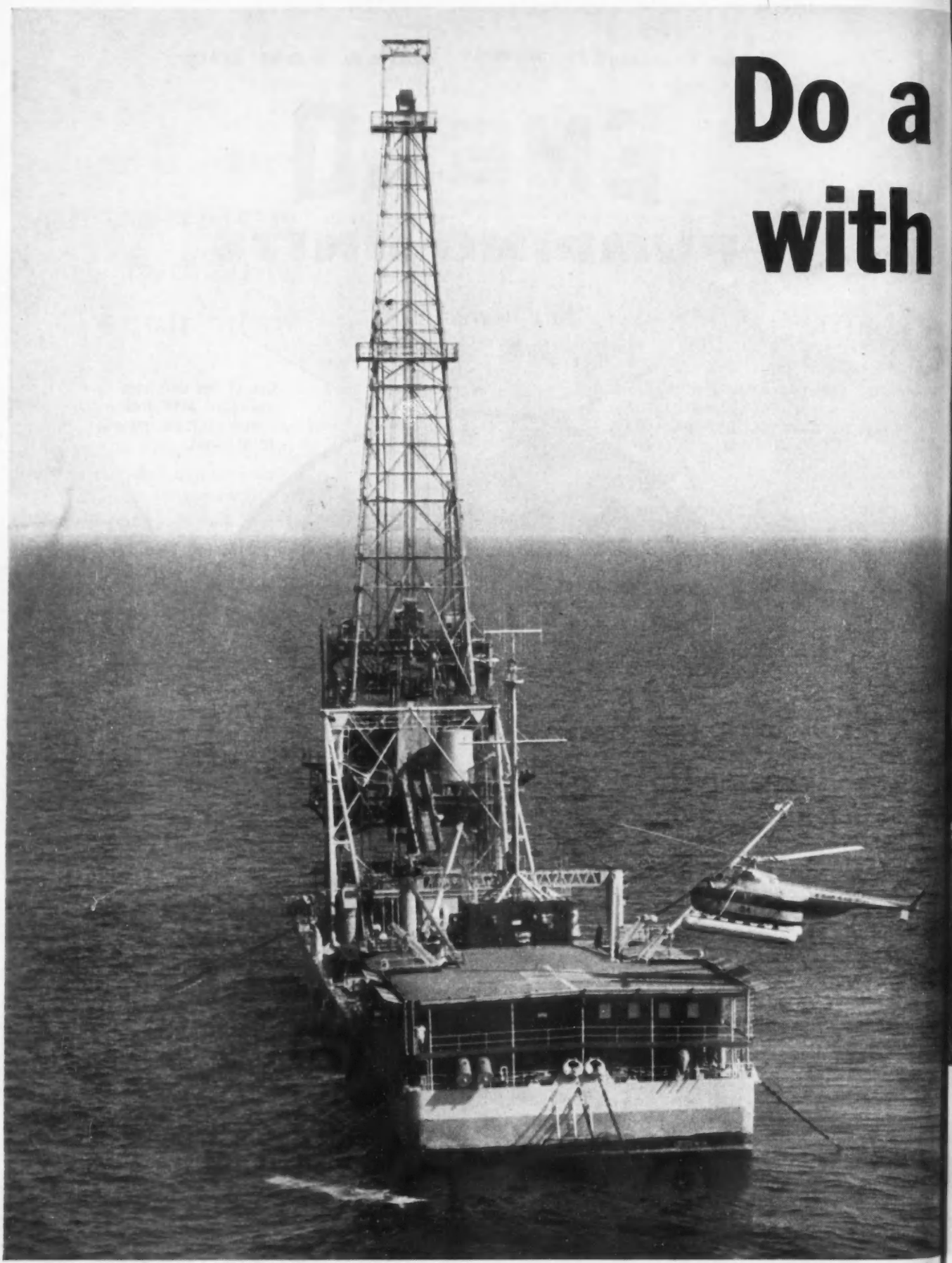

REGULAR, SCHEDULED FLIGHTS between rigs and shore bases simplify the offshore transportation problem. The 85 mph cruising speed of the Sikorsky S-55 makes the offshore trip quick and comfortable. Passengers step easily, safely from the helicopter cabin onto landing platforms on tenders or on rigs.

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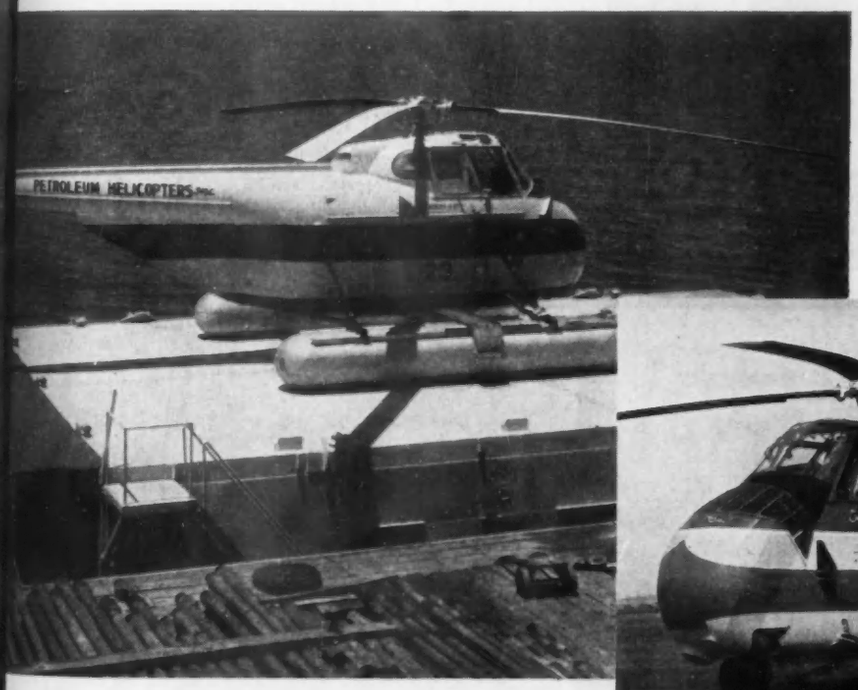
better job offshore Sikorsky Helicopters

Oil companies active offshore in the Gulf of Mexico area are discovering the clear-cut advantages of using big, dependable transport helicopters. Shuttling to and from rigs on routine trips or to meet rush needs, Sikorsky helicopters are today earning their way in both oil company and charter operation.

Fast and powerful Sikorsky helicopters in normal operations carry about 20,000 crewmen and specialists each month in the Gulf of Mexico area. Even the most distant rigs are reached easily, in a few minutes, and on short notice.

In today's service offshore, Sikorsky helicopters are again offering proof of their dependability and versatility . . . qualities which have been repeatedly shown in successful operation in jungles, at sea, in deserts, and in mountain areas.

The familiar Sikorsky S-55 and its new companion, the even larger S-58, are the acknowledged leaders in the transport helicopter field. They offer a solution for many of your offshore transportation problems.



SIKORSKY HELICOPTERS pay off in many ways. They cut investment in surface transportation, cut down generally high overhead costs by saving hour after hour of valuable time. At left, an S-55 lands aboard a deep-water rig on a platform built atop the crew's living quarters.

EVEN LARGER SIKORSKY S-58s, proved by the military and now available commercially, are being ordered with flotation gear for offshore service. Here, Okanagan Helicopters Ltd. accepts delivery of an S-58 scheduled for high-priority cargo work in the remote Canadian North. An S-58 can carry 12 passengers 150 miles offshore and return without refueling. It cruises at better than 100 mph.

For more information on Sikorsky helicopters, telephone or write B. L. Whelan, general manager, Sikorsky Aircraft.

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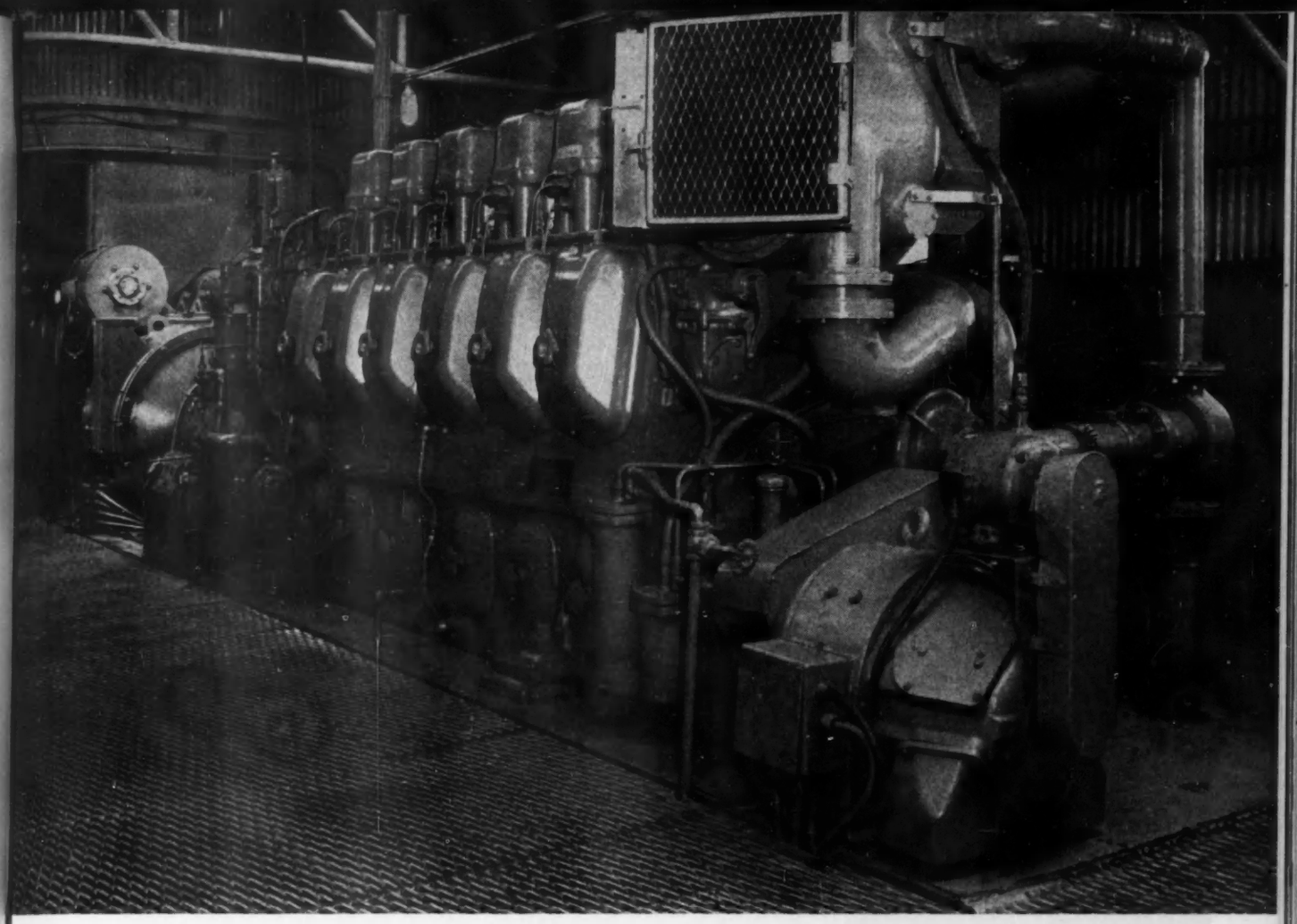

ALCO 251-B DIESEL ENGINE *in service on Shoreline Drilling Company oil-well drilling barge. Barge recently completed its second hole, which went 15,000 ft deep. First* ALCO *plant, owned by Bateman Drilling Co., has drilled over 80,000 ft. Offshore Company's first* ALCO*-powered rig has completed two holes. Drillers report excellent performance of* ALCO *equipment.*

NEW ALCO DRILLING PLANT GIVES COMPLETE POWER, SMOOTH CONTROL, FLEXIBILITY

Plant Provides All Power For Drilling; Includes Split-Second, Reliable Control; Skid-Mounted Units Solve Weight Distribution and Add Flexibility.

The ALCO drilling plant provides all the advantages of diesel-electric power: smooth, pin-point control, steady acceleration without load shock to engines and other equipment, power that's instantly available. It means that you can spend more time drilling, less time in mechanical control changes and equipment maintenance. It even means that you spend less time changing bits, or pulling your string out of the hole for any reason. In addition, the ALCO plant can drill as long as one engine is running—it does not depend on auxiliary generators or engines.

All components are skid-mounted. You distribute weight on a barge as required, save setup time on land installations. Components can be trucked from location to location.

Two engines in the ALCO plant provide 1370 hp for draw-works drive and 600 hp for each of two mud-pump drives, plus power for lighting and other auxiliaries. A wide variety of modifications is available, such as larger mud-pump, rotary and coring reel drives.

The ALCO plant's cost is comparable to that of an ordinary plant. It is built and backed by the pioneer of locomotives and diesel-electric power. Contact your nearest ALCO representative or write P. O. Box 1065, Schenectady 1, N. Y. for details.

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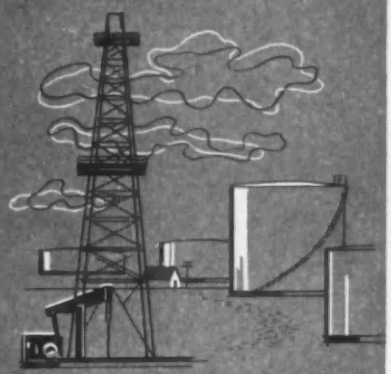
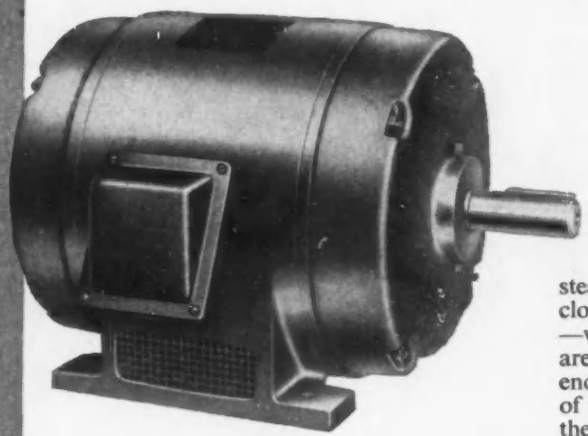
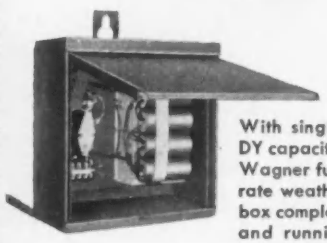
there's a Wagner Motor for every job

...in the oil fields





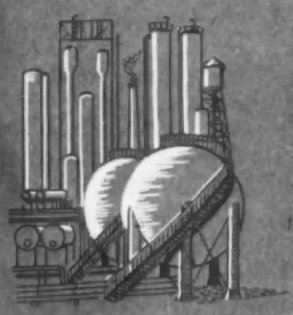


With single-phase Type DY capacitor start Motors, Wagner furnishes a separate weatherproof control box complete with starting and running capacitors and voltage relay.

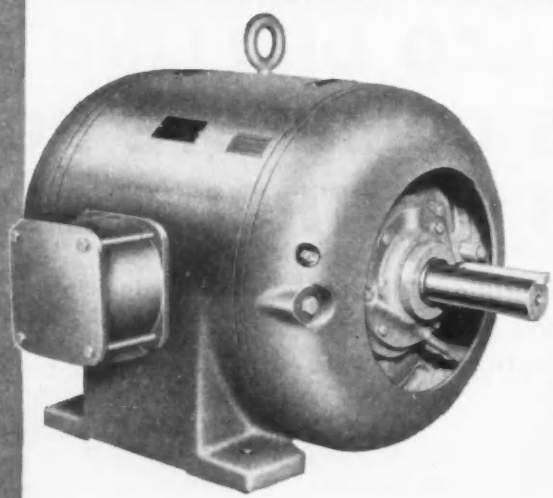
OIL WELL PUMPING MOTORS

Wagner cast-iron frame oil well pumping motors, either polyphase or single-phase, are especially designed for rugged, steady, outdoor service. The enclosures are completely drip-proof —virtually splash-proof. Air intakes are located at the bottom of the endplates to admit a cooling flow of air to the motor, while retarding the entrance of water. Outlets are located at the base of the frame, one on each side. Screened openings keep reptiles or small animals from entering the motor. The conduit box is moisture-proof and dust tight. For locations where only single-phase current is available, Wagner can furnish high power factor type capacitor-start motors with the same enclosures. You can get Wagner Oil Well pumping motors *from stock* in your immediate area.

...in the refinery



EXPLOSION-PROOF MOTORS



These powerful Type JP polyphase motors are expressly built for applications in explosive atmospheres. They are approved for Class 1 Group D hazardous locations. Totally-enclosed fan-cooled construction, with frames and endplates of cast iron, makes them suitable for indoor or outdoor use and for installations where corrosion is a problem. Available in ratings through 250 hp.

For full information, write for Bulletins MU-132 and MU-137. Thirty-two branch offices are ready to assist you in any motor application problem.

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EST. 1891

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Wagner Electric Corporation
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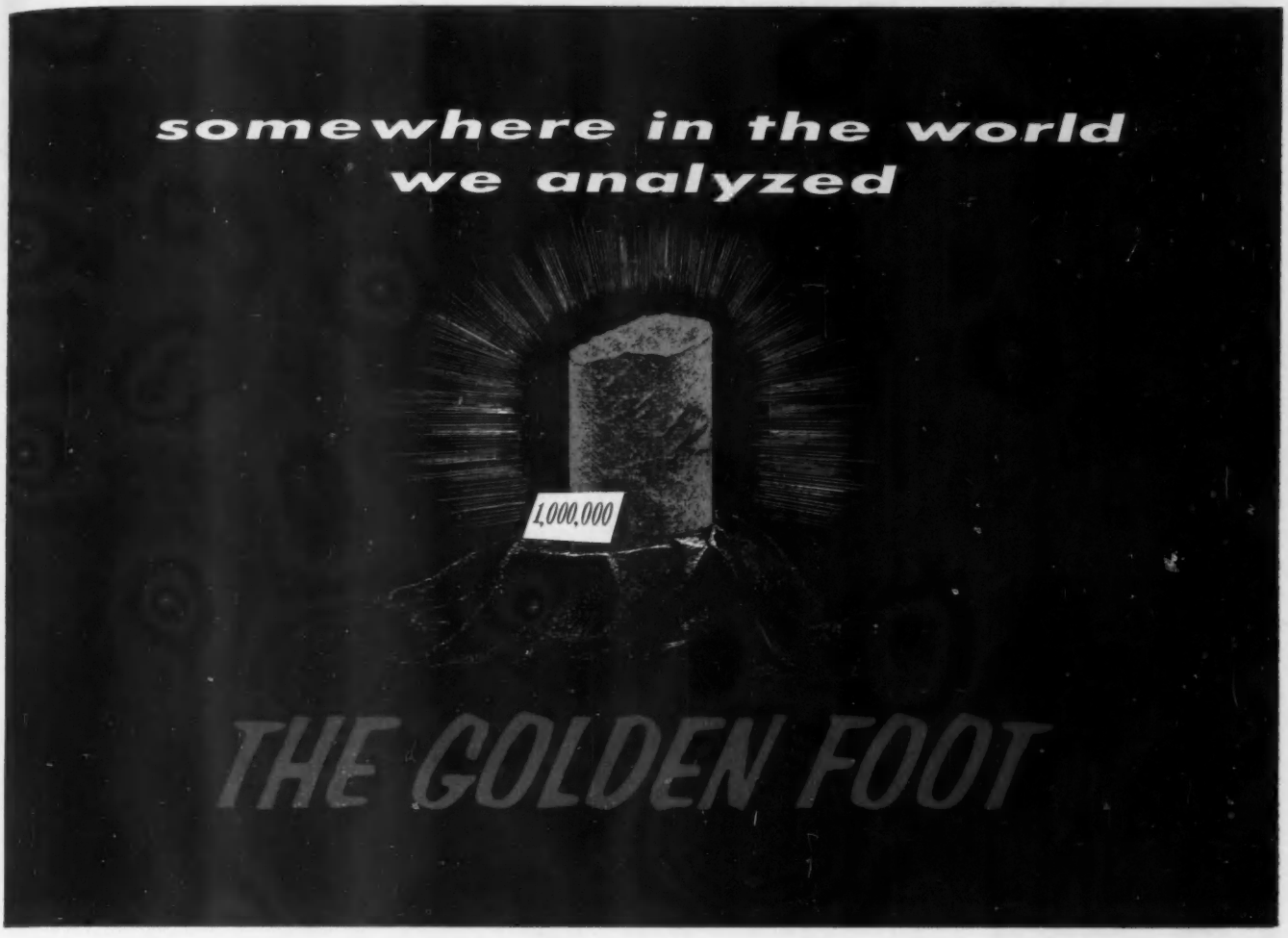

Somewhere . . . sometime during October 1956, we met and analyzed *The Golden Foot* — the one-millionth sample to be evaluated by Core Lab personnel.

Naturally, we would have liked nothing better than to have appropriately publicized the precise foot, the area, the formation, and the client. But with core being run in *thirty-nine* Core Lab installations, day and night, such identification was impossible.

The Golden Foot may have been run in one of our new labs at Farmington, McAllen, Long Beach, or Craig. It may have been analyzed in Lafayette, Edmonton, Bartlesville, or Monahans. Whenever and wherever it occurred, the fact remains that a million feet of analysis is a significant symbol of progress — not only for Core Lab but for the industry, as well.

Every year since 1936, more and more operators have turned to core analysis as the source of *virgin data*—basic reservoir facts which directly influence technical and financial steps throughout the productive life of a field.

To Core Lab, The Golden Foot represents a plateau of stability — and the opportunity to broaden its research, advance the technical background of its employees, add new services, and to maintain its position as the industry's greatest single source of petroleum reservoir knowledge.

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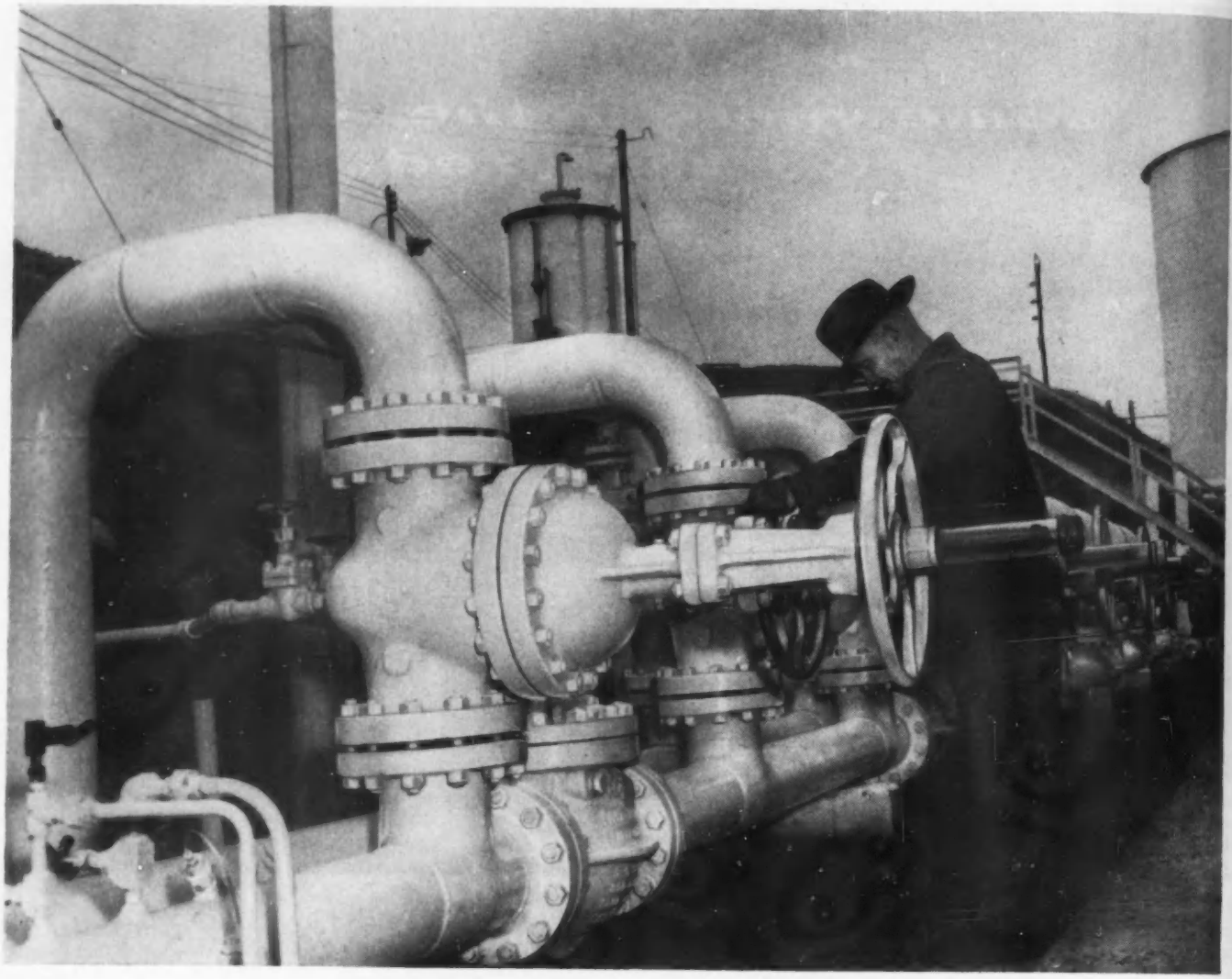


How one Crane valve gives double block protection at half the cost

Each of these Crane valves is doing the work of two.

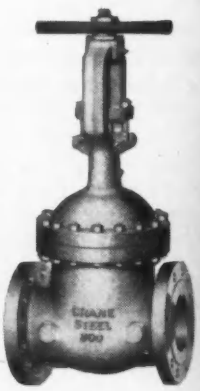
The valves are Crane 61 XU 400-pound steel gates modified with flexible wedge disc. They're installed in the pump manifold at the Borger main pump station of Phillips Pipeline Company's Borger-Chicago products line. This line was looped in 1951 to handle dissimilar products.

The header consists of 13 eight-inch valves, each with a telltale bleeder connection at the bottom. Depending on the product being handled, inlet pressure on the upstream side of a closed valve may be from 20 to 200 psi. Downstream pressure may go as high as 1100 psi. With the bleed valve open to atmosphere, there is *no leakage*.

Double-blocking is accomplished with a *single* valve fitted with a bleed line, cutting installation costs in half. Station personnel have half as many valves to operate. Product contamination is eliminated.

If you have a valve application where double valve, or valve and blind with bleeder, is indicated, why not get the facts on Crane flexible wedge disc gates?

Just ask your local Crane representative or write to the address below.



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GET THE FACTS
on wire lines for drillers

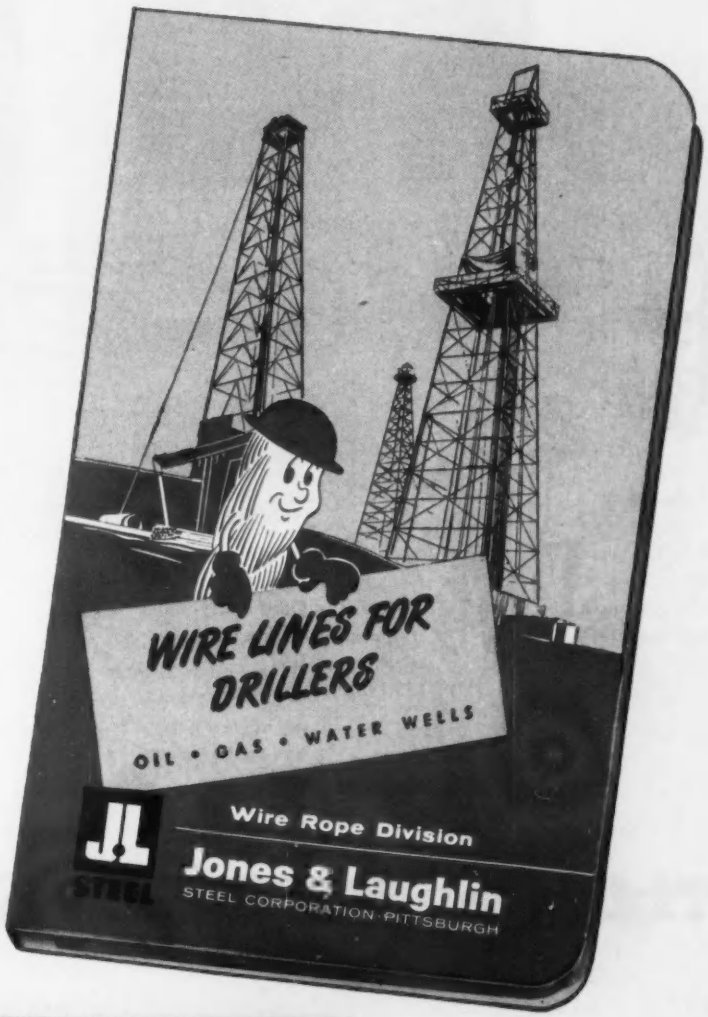
Write today for this informative handbook. The information on PLASTIKORE wire rope is of special interest to cable tool drillers.

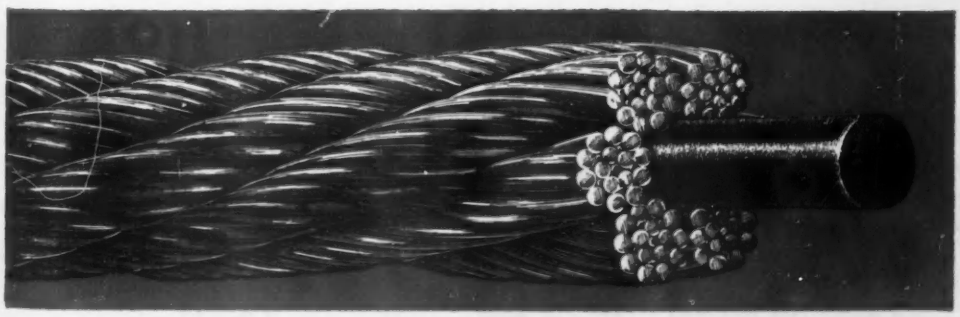
Here are some reasons why you, too, can profit by specifying J&L PLASTIKORE wire rope:

THE PLASTIC CORE . . . is unaffected by salt water, acids, caustics and moisture which often cause rapid failure in standard fiber center wire ropes when used for well drilling.

THE PLASTIC CORE . . . has more uniform diameter. Retains resiliency, gives cushion-like, firm, uniform support for outer steel strands throughout the complete length of the rope.

THE PLASTIC CORE . . . has joints which are fused under heat, resulting in a connection that gives a permanent, continuous, uniform center in which no splice failure is possible.





Take advantage of these features for longer service life from your drilling and sand lines. Ask your J&L Wire Rope distributor about PLASTIKORE, or write us direct for the source nearest you.

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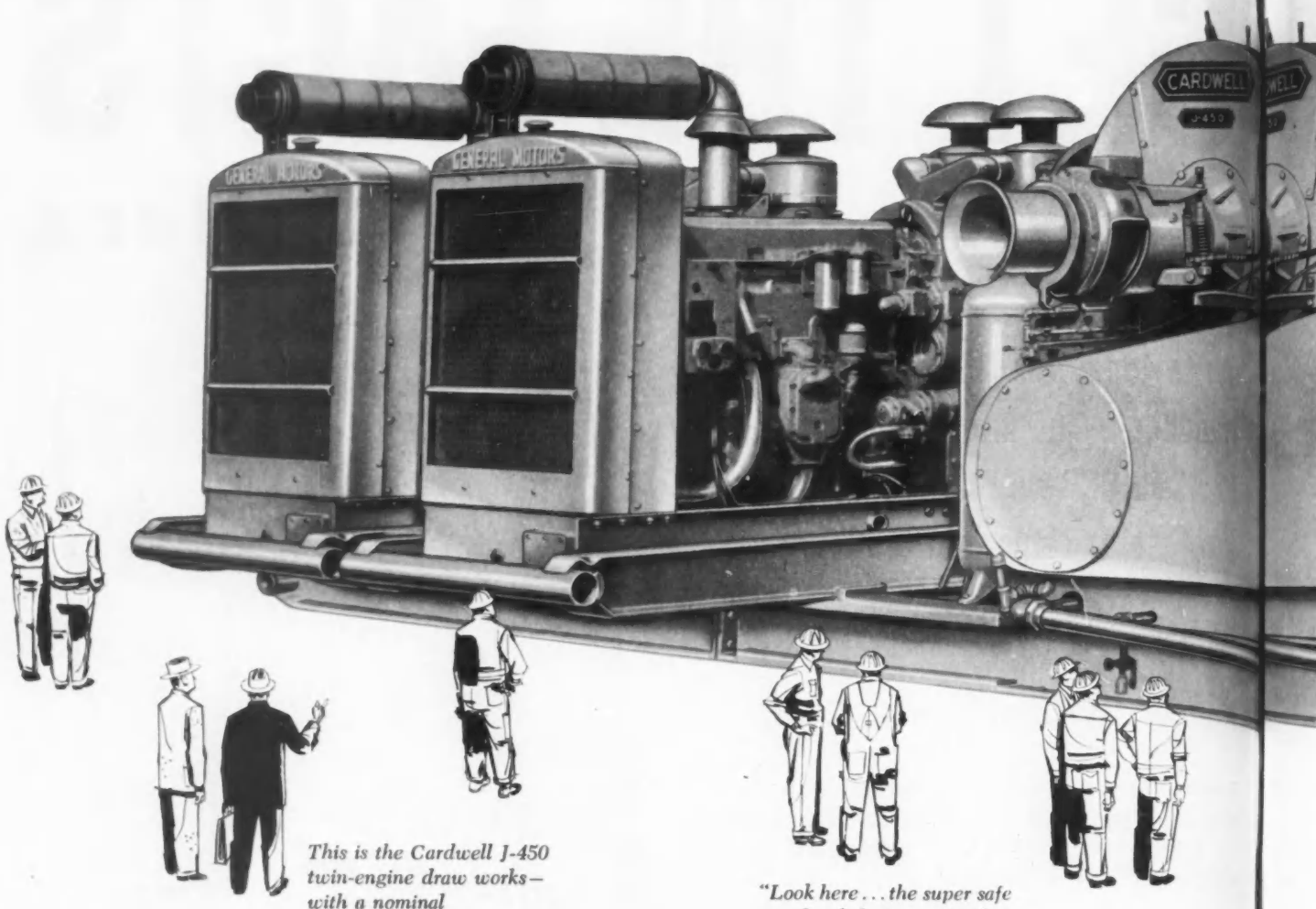
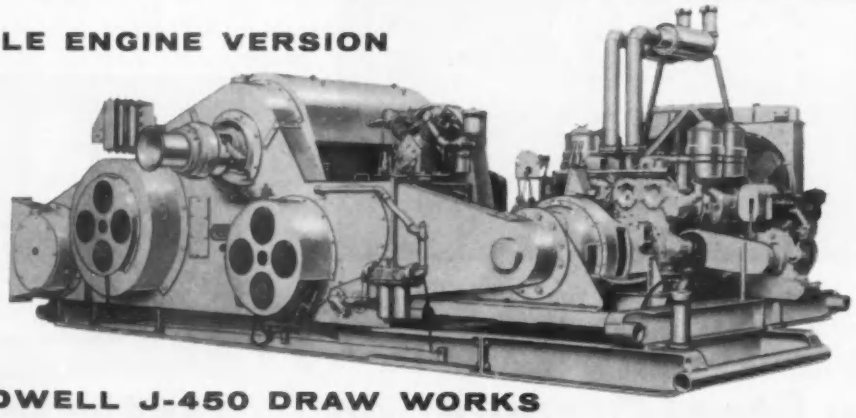


This is the Cardwell J-450 twin-engine draw works—with a nominal 520 input horsepower.

"Look here . . . the super safe cathead shaft permits slow speeds without idling engines or shifting gears."

. . "the BIGGEST value in

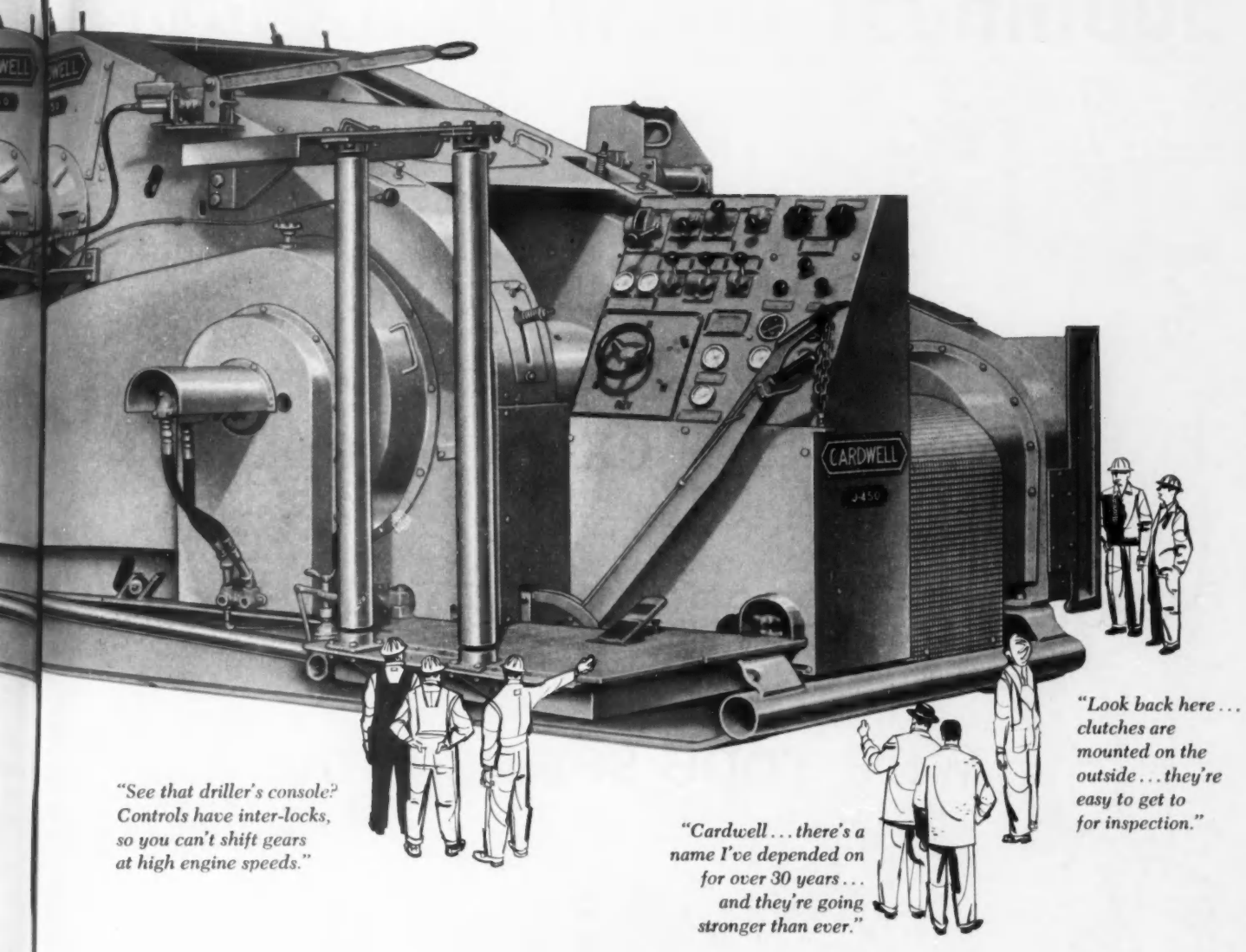
SINGLE ENGINE VERSION



CARDWELL J-450 DRAW WORKS

Single Engine Features

- Torque Converter Driven.
- Air Friction Clutch Drive for Main Drum and Cathead Shaft.
- Serves as split rig, if desired.
- Hoist portion identical to Twin-Engine Model J-450 and adaptable to same accessories.
- Maximum Input Horsepower 520.



"See that driller's console? Controls have inter-locks, so you can't shift gears at high engine speeds."

"Cardwell... there's a name I've depended on for over 30 years... and they're going stronger than ever."

"Look back here... clutches are mounted on the outside... they're easy to get to for inspection."

DRILLING RIGS today!"

It's a tool pusher's dream... and an owner's delight! Your men will like Cardwell's J-450 because of its fast, efficient operation. You will like it because it reduces drilling costs! The advanced engineering in Cardwell's J-450 twin-engine draw works provides you with maximum flexibility and maximum adaptability to barge, trailer, or skid operation.

– And, Cardwell's rigidly exact quality control – the result of more than 30 years' experience – protects your investment, and reduces costly downtime – for years to come. We invite you to "call on Cardwell."

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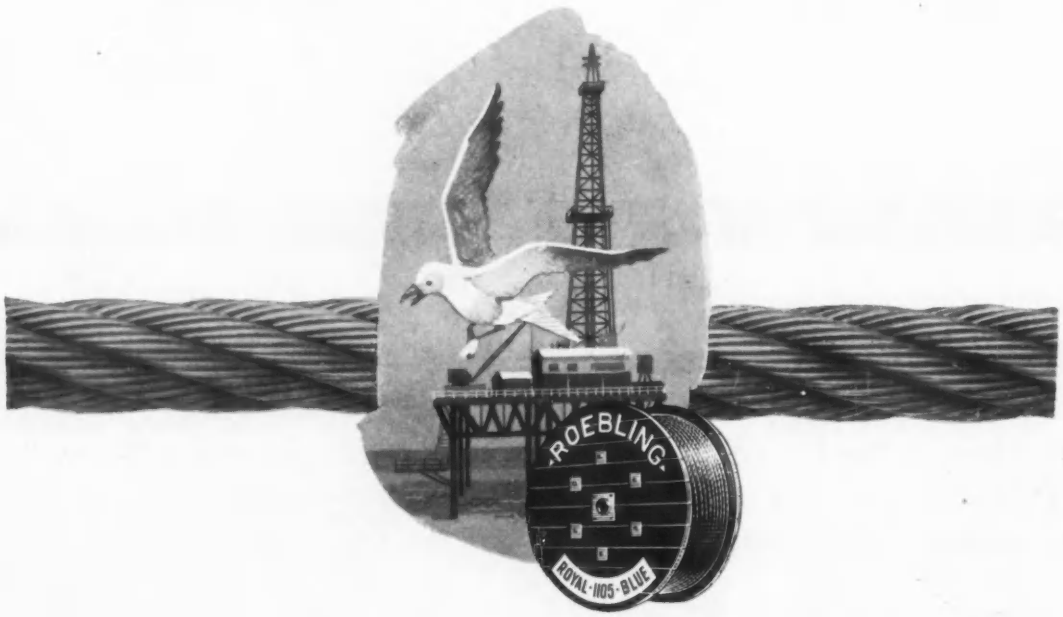

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Timing is vital

when running and cementing casing

Poor timing can mean a costly remedial job, loss of oil, or a possible blowout. From the moment the drill pipe is laid down until the cement sets in place behind the casing, timing is critical.

For example, mud should not be allowed to set, uncirculated, in the uncased hole too long. The longer the delay, the more pressure is required to overcome the inertia of the thickened mud column, and the greater the danger of upsetting the delicate balance between mud weight and formation pressures. Hence, the need to keep elapsed time at minimum, the need for speed when making up the cement head and prefitting the casing with properly spaced reversible scratchers and centralizers.

When running casing, too, timing is vital. It must not be run faster than the mud column can be displaced, (because of destructive hydraulic pressure surges), yet if it is run too slow, valuable rig time is wasted. Stopping casing movement can cause gelled mud, drill cuttings and sloughings to pack off against the pipe and stick it. To avoid these dangers, casing must be run in one smooth operation.

After scratcher and centralizer-equipped casing is run, it must be reciprocated long enough to remove all excess hole growth, and until gelled mud and cuttings are circulated out. In certain wells this can take up to several hours. Here again timing is vital.

The Weatherford Technique, using Weatherford equipment, is your best assurance of a well-timed casing operation and a better cement job. Call the man from Weatherford.

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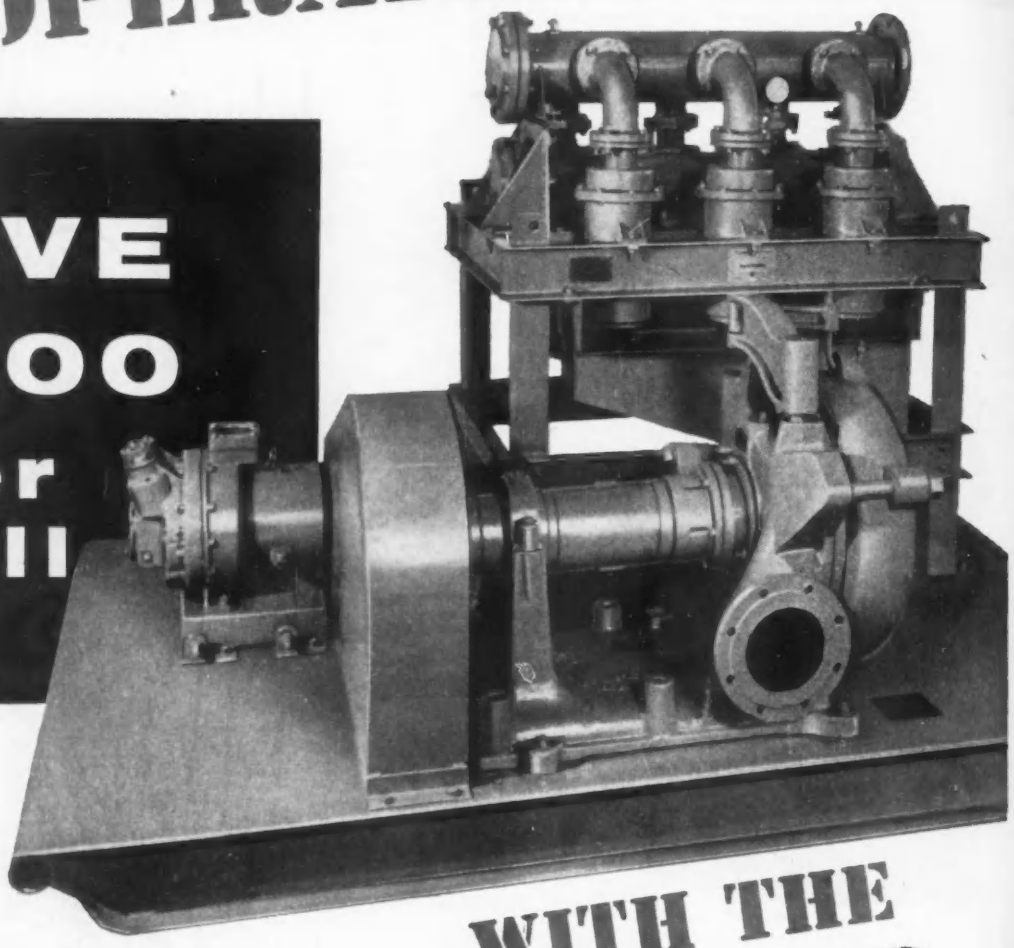
GENERAL OFFICES: 5920 Navigation Blvd., Houston, Texas

RIG OPERATORS...

SAVE $3500 Per Well



WITH THE DORRCO D-SANDER

Sand-free rotary drill mud can mean big dollar savings. A Dorrco D-Sander on your rig will continuously return to the mud pump a mud containing less than 0.2% API sands. Here's what this means in actual savings . . .

★ Drilling and reaming time are reduced.

★ Jet bit performance is increased up to 20% with a corresponding saving in the number of round trips. Conventional bit performance is increased still greater.

★ Slush-pump maintenance costs are drastically reduced. Average life of vital pump parts is increased as much as 400%.

★ Maintenance costs on mud system are greatly reduced as a result of eliminating sand abrasion in mud lines, mud valves, and swivel washpipes.

★ Tank cleaning while drilling fast sandy holes is eliminated.

★ No sand settling in the hole means no sand bridges or tight spots . . . surface pipe runs more easily.

★ Overall rig savings average $3500. per well on existing installations!

DorrClone — T. M. Reg. U. S. Patent Office

For more information on this important development in drilling technique write for a copy of Bulletin No. 2506. U. S. Sales Representative: Salt Water Control, Inc., 1211 Ft. Worth National Bank Building, Ft. Worth, Texas.

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Do you require lightweight, fast rotation drilling for crooked hole country . . .? Or – do you need deep penetrating action for the softer formations? Whatever your specific requirements – there's a CP Bit for your exact needs! Chicago Pneumatic's complete line of Three Cone Rock Bits and Jet Bits includes seven different types for all kinds of formations from soft to exceedingly hard and abrasive.

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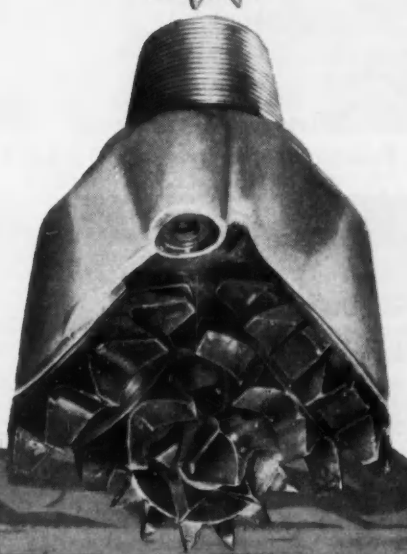

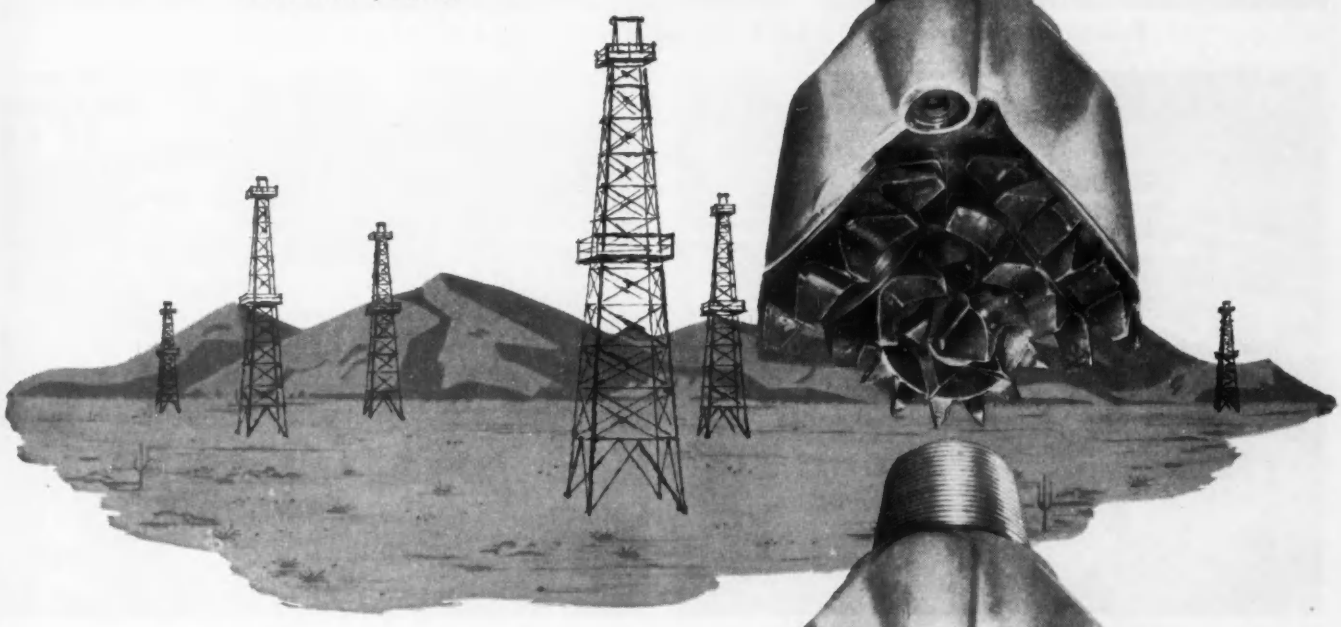

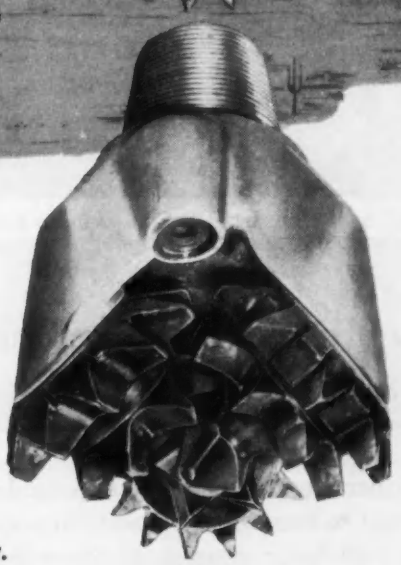

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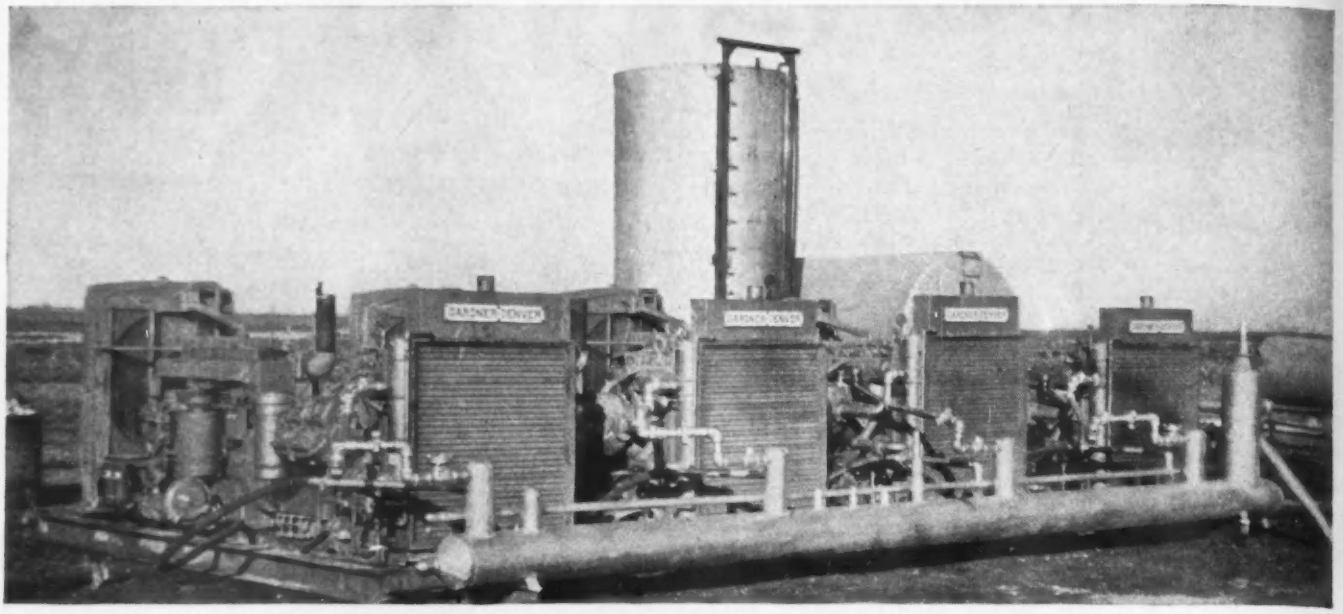
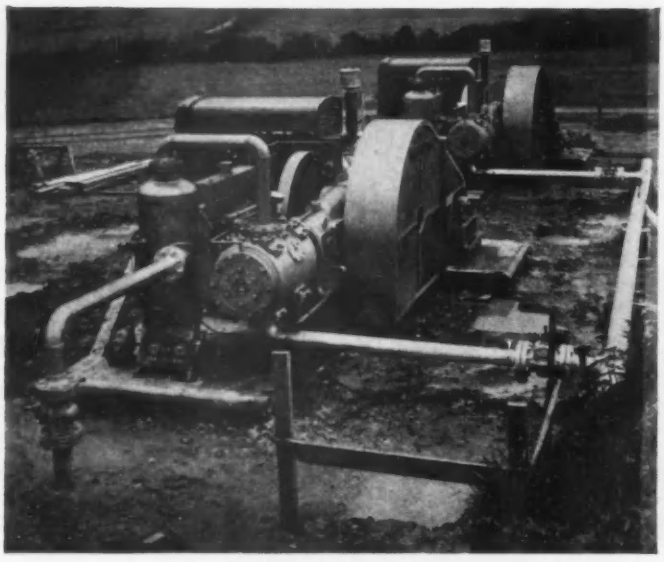
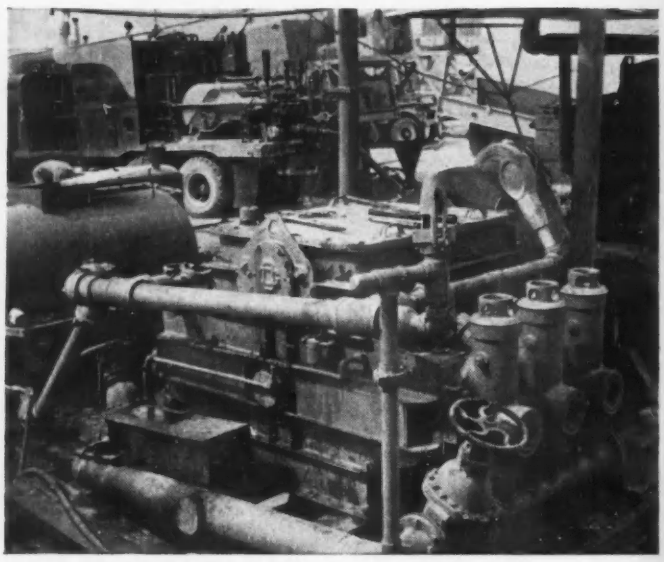


Four Gardner-Denver Model WEK Compressors skid-mounted with engines for air drilling.



4¾" x 11" Model RX Compressors boosting air pressure for mud aeration.



Gardner-Denver Model PL-7 Triplex Plunger Pump works on mud aeration job.

In air drilling and mud aeration

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There are Gardner-Denver quality pumps and compressors designed to handle any air drilling or mud aeration job. Call your nearest Gardner-Denver representative for details. Gardner-Denver service specialists are on call in: Houston, Corpus Christi, Odessa, Wichita Falls, New Orleans, Shreveport, Oklahoma City, Ellinwood, Casper, Edmonton, Tulsa, Pittsburgh and Los Angeles.

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The metal pipe shown in this illustration is typical of lines that become plugged in from three to six months. Southwestern Tenite Butyrate Plastic lines in the same areas have remained trouble-free for almost two years.

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- **ROLLER BEARINGS** assure accurate, instant bit feed and sensitive drilling control.
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- **RUGGED ENCLOSED** body with one piece solid cover.

For further information write P.O. Box 1348, Houston 1, Texas or see The Composite Catalog.

The advanced, two-roller design of the Baash-Ross bushing virtually eliminates all twisting strains. The sure, sensitive feed assures steady, uninterrupted drilling—longer equipment life. A million wells have been completed at lower cost because Baash-Ross tools were on the job.

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The "DBM" Multiplex is the clean-contoured block with a low center of gravity that gives it exceptional balance. The favorite where the going is toughest—on a portable rig demanding high capacity—plus compactness.

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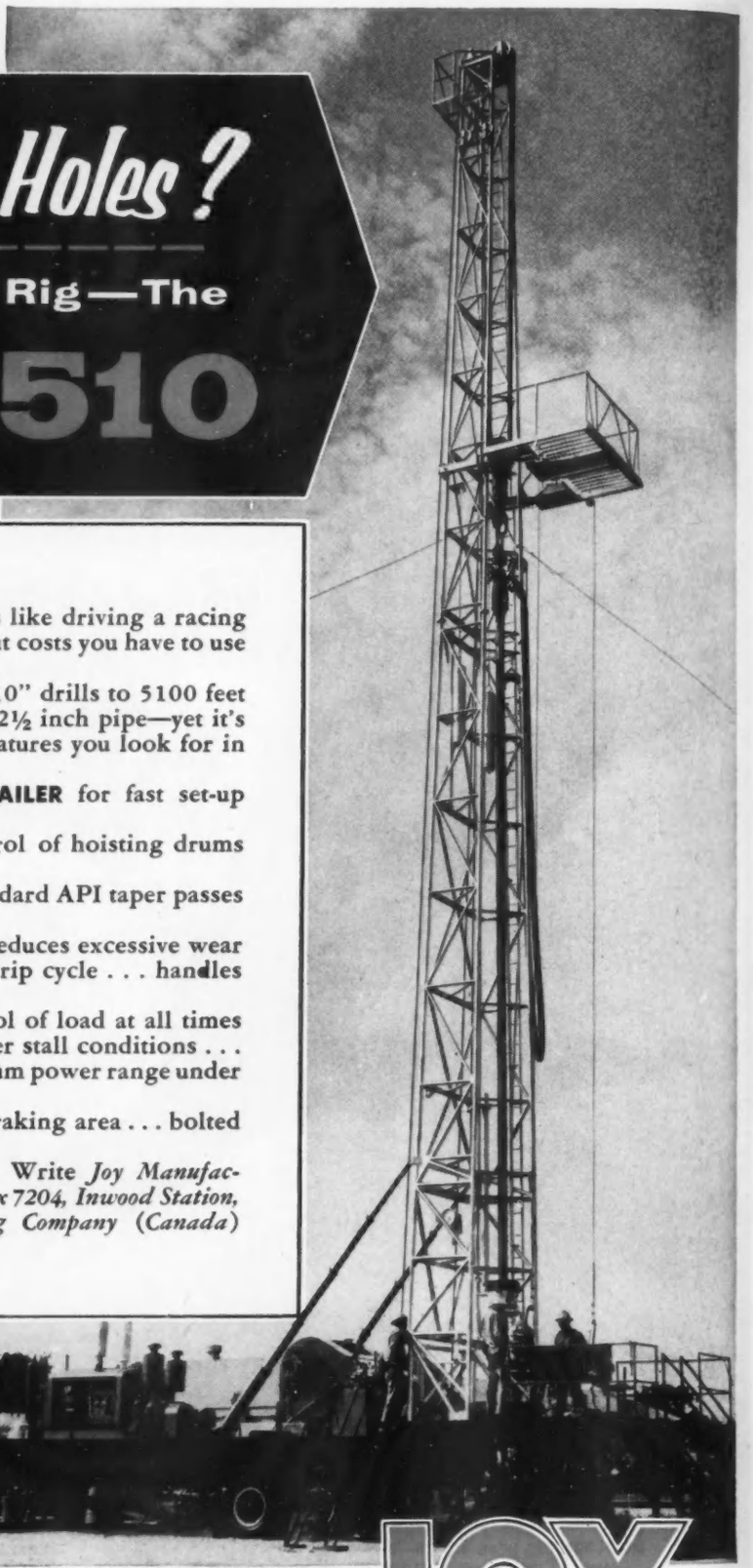
Drilling Slim Holes?

Use a Slim Hole Rig—The

JOY 510



Drilling Contractors:

Drilling slim holes with a conventional rig is like driving a racing car at tractor speeds—it's wasteful. To really cut costs you have to use a rig specifically designed for slim hole work.

Here's that rig—the Joy "510." The Joy "510" drills to 5100 feet with 3½ inch drill pipe . . . 10,000 feet with 2½ inch pipe—yet it's completely portable. The "510" has *all* the features you look for in a rig:

ENTIRE DRILL UNIT MOUNTED ON ONE TRAILER for fast set-up and tear-down

AIR-OPERATED CLUTCHES for sensitive control of hoisting drums and rotary drive.

LARGER ROTARY TABLE OPENING with standard API taper passes large diameter bits and casing.

HYDROMATIC BRAKE ON HOISTING DRUM reduces excessive wear on brake linings and flanges throughout trip cycle . . . handles heavy loads . . . safer.

TORQUE CONVERTER insures complete control of load at all times . . . three times normal engine torque under stall conditions . . . permits engine to operate within its maximum power range under a wide variety of loads.

ALLOY STEEL BRAKE FLANGES have larger braking area . . . bolted to drum for easy replacement.

GET COMPLETE SPECS ON THE JOY "510". Write *Joy Manufacturing Company, Oil Field Drill Division, P.O. Box 7204, Inwood Station, Dallas, Texas.* In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

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Second Year for X2 Rods in the Crookham No. 1

A tapered string, made up of 4600 ft of ¾-in. and 1950 ft of ⅞-in. Bethlehem X2 carbon-manganese sucker rods, is now in its second year of service in the Crookham No. 1 Well, in the Whitesboro Field near Sherman, Texas.

The Crookham No. 1 is operated by Midwest Oil Corporation. It is equipped with a Bethlehem 160D-20S pumping unit, and is producing 26 bpd of 26-gravity oil, with some water. Production is currently from 6550 ft, from the lower Dornick Hills Sands.

The Bethlehem X2 rod is ideal for medium pumping duty in non-corrosive wells, as well as in wells which are properly inhibited, because it is made from top-quality carbon-manganese steel. Besides, it is carefully normalized to provide uniform mechanical properties.

In addition to the X2 rod, Bethlehem produces three other grades of carbon and alloy rods, plus a full line of accessories. With so wide a range from which to choose, you'll have little difficulty in selecting a rod to meet virtually any pumping condition or corrosion problem. If you would like to learn more about Bethlehem sucker rods, just get in touch with your Bethlehem distributor.

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Window by Charles J. Connick Associates (Boston) in St. John's Episcopal Church, Newtonville, Mass. • Copies for framing on request • (20-1)

". . . they presented unto him gifts; gold, and frankincense, and myrrh."

Window by Charles J. Connick Associates (Boston) in St. John's Episcopal Church, Newtonville, Mass. • Copies for framing on request • (20-1)

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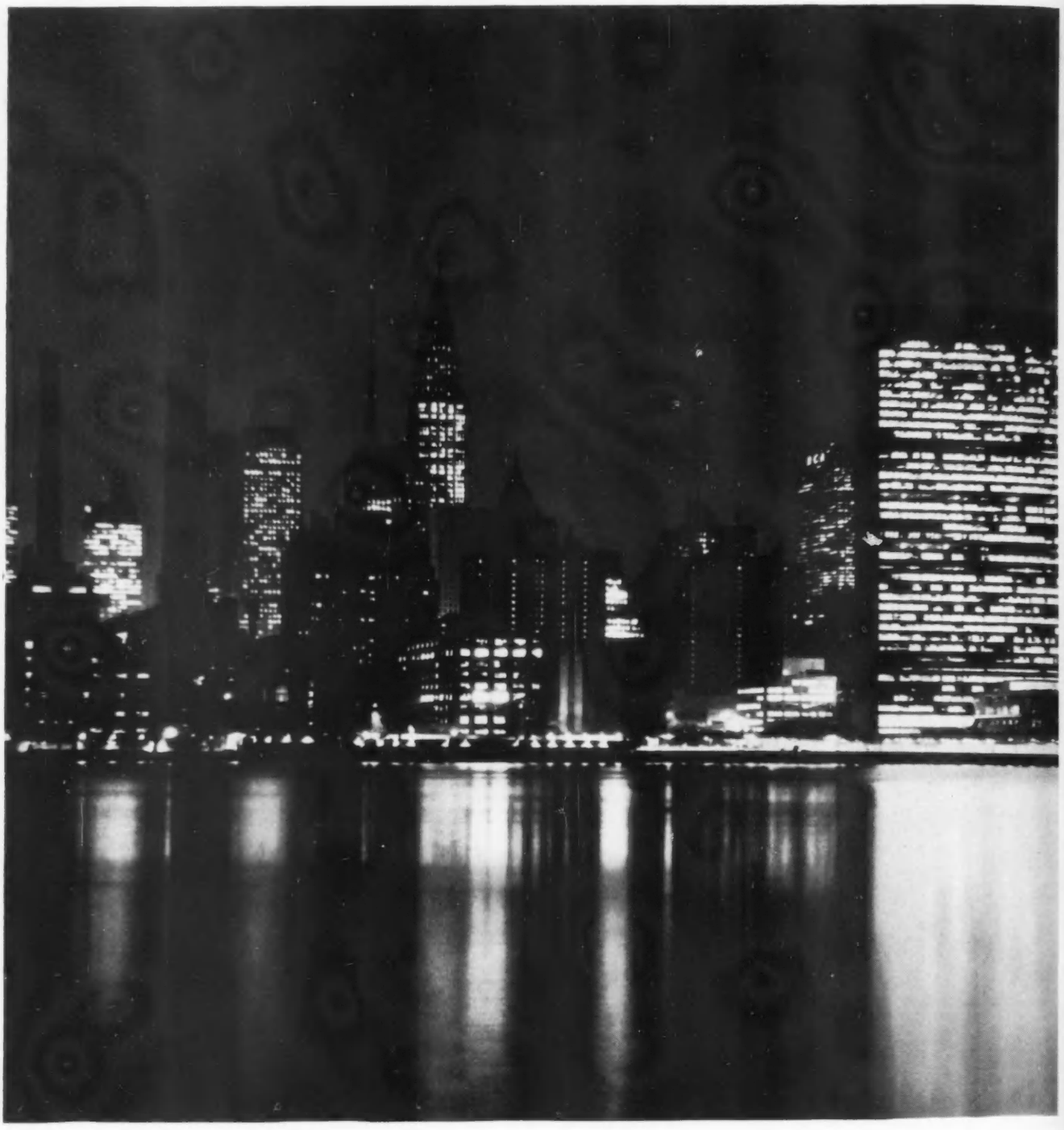

"The long-range energy requirements of the United States and the world are so great that no one form of energy, as we know our energy resources today, can hope to meet more than a fraction of these requirements. There is room and need for all forms of energy, and we see nothing ahead in the oil business but a demand for more and more oil."

A statement by M. J. Rathbone, President, Standard Oil Company (New Jersey)

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STANDARD OIL COMPANY (NEW JERSEY)
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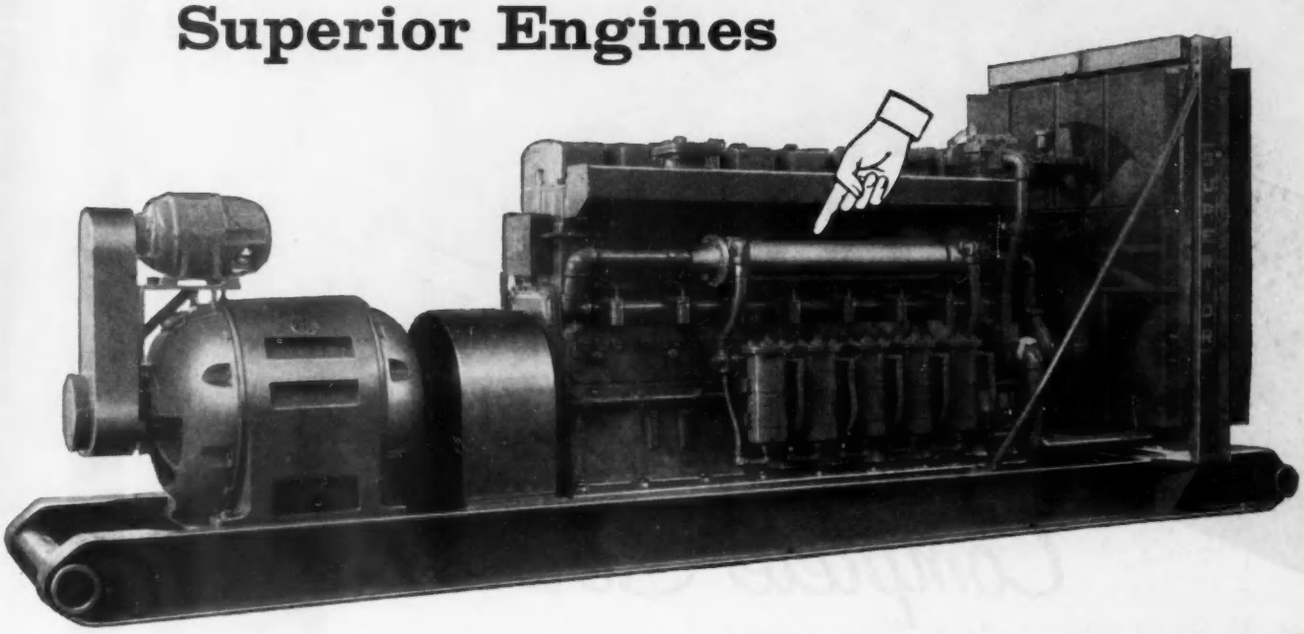
ROSS EXCHANGERS
hold lube oil at proper temperature in Superior Engines



Powering pumping motors, this 8-cylinder Superior Engine Generator Set is one of six on duty at a lease operated by a major oil company in Wyoming.

To protect close clearance parts by keeping lube oil at the *right* temperature and viscosity, each engine is equipped with a Ross Type BCF Exchanger. Efficient, dependable cooling is assured!

Regularly installed to safeguard the performance of numerous types and makes of prime equipment serving oil fields, pipe lines and refineries, Ross Exchangers are unequaled for ruggedness and thermal efficiency. Pre-engineered and fully standardized, they're available in a wide range of sizes for cooling oil, water, air, gas and hydraulic fluid.

For detailed information, request Bulletin 1.1K5. Ross Heat Exchanger Division of American-Standard, Buffalo 5, N. Y. In Canada: American-Standard Products (Canada) Limited, Toronto 5, Ont.

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ROSS HEAT EXCHANGER PRODUCTS

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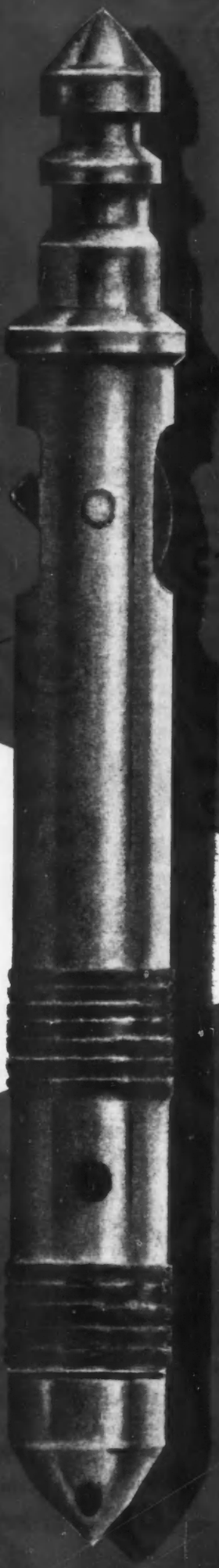
Complete Service

GAS LIFT AND WIRE LINE



For your copy of Camco's all-new 1957 catalog, featuring gas lift equipment and wire line service, write:

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turns waste time into work time

You get *extra* money-making *work time* with an Allis-Chalmers crawler tractor on every oil field job—dozing, winching, towing, pushing. Built for today's jobs, these crawlers are wheeling out more work in less time than comparable size machines.

Look at the facts

1,000-hour lubrication intervals save lube time

Allis-Chalmers tractors start the day with *go*—not greasing. You can operate six months on a 40-hour week basis with just one lubrication of truck wheels, front idlers and support rollers. Designed with Positive Seals and tapered roller bearings, these units are protected from dust, loose sand, soft ground, mud or water. You not only gain *working time*, but save labor and lubricant costs as well. And there's no costly damage from greasing neglect.

Modern shift pattern speeds digging

Here's a big timesaver on slush pit digging. It takes just half the time and effort to change from low forward to fast reverse with the Allis-Chalmers HD-6, HD-11, or HD-16 transmission. One simple shift of the gear lever does the job. You gain production time—up to 25 percent on actual test—on bulldozing, backfilling and other jobs calling for a short forward-backward cycle.

Unit construction cuts servicing time

No need to remove transmission or engine, radiator, grille, when servicing or removing an Allis-Chalmers master clutch. This unit can be removed without disturbing adjacent parts. This is also true of other main assemblies—final drive gear, transmission, steering clutches, engine and truck frame. You can quickly substitute an assembly and put the tractor to work while servicing the original unit. As a result, hours of *costly service and downtime are saved* because of Allis-Chalmers advanced design.

These are just three examples of Allis-Chalmers timesaving, money-making features. Your Allis-Chalmers dealer can point out many more. See him now for the full story.

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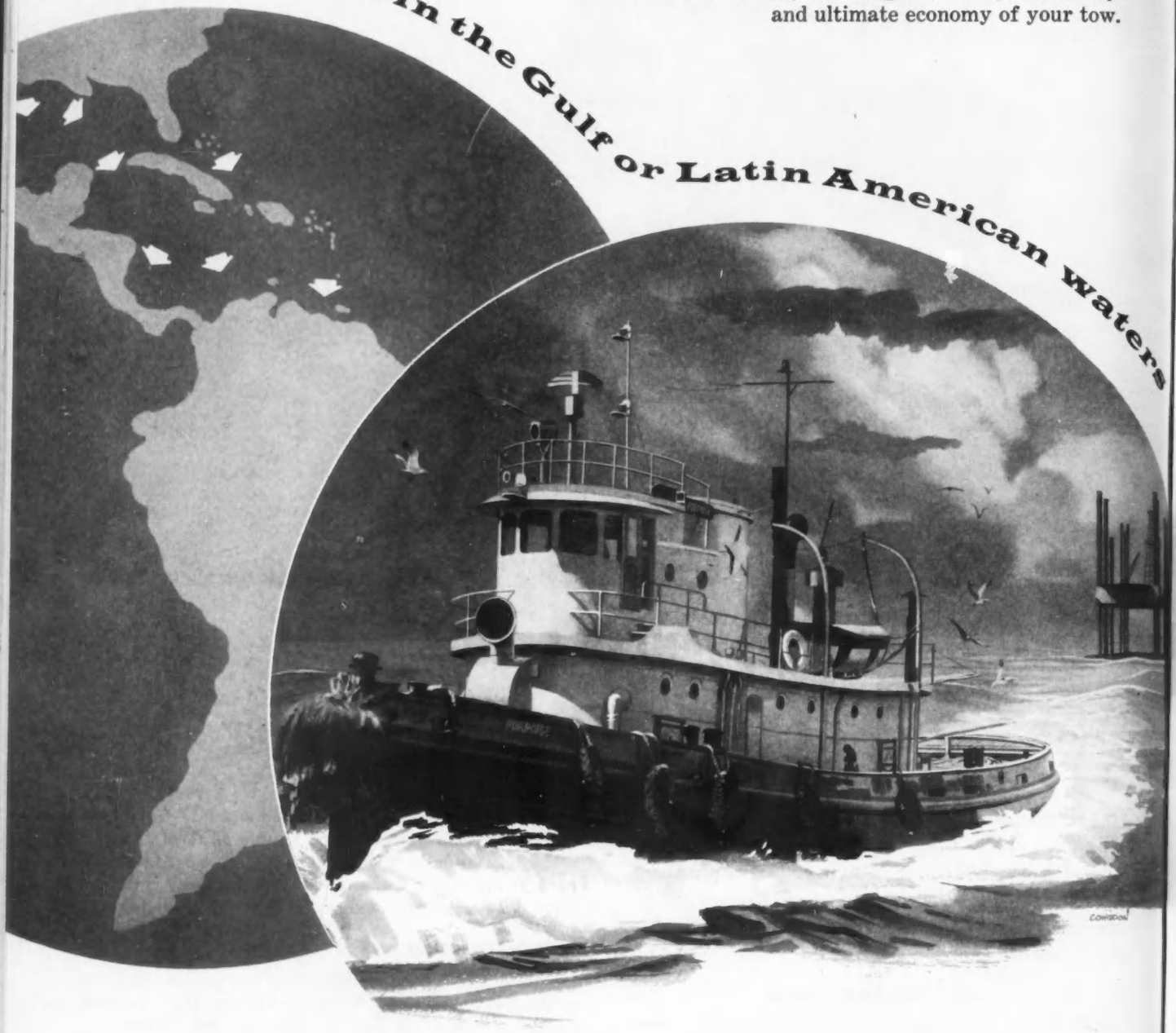
Anywhere in the Gulf or Latin American waters



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Pioneers in Gulf Coast tidelands towing, G & H has capably handled every conceivable towing assignment. No job has proved too large. None could be too small. If it floats, G & H can tow it . . . well . . . anywhere in the Gulf or Latin American waters. Call the G & H office nearest you today, and let towing experts help you solve your offshore towing problems. No obligation, of course.

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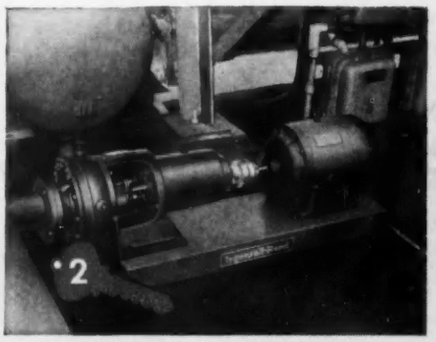

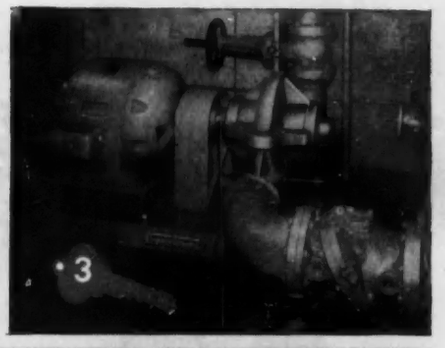

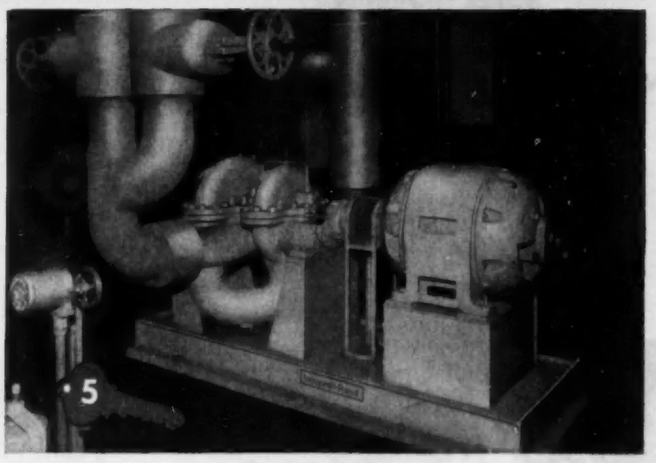

Five Keys to LONG-RANGE ECONOMY on your general-purpose pumping jobs

The Ingersoll-Rand pumps shown feature several different designs and types. Yet they all have one thing in common—the ability to give you low-cost performance on your general purpose pumping jobs.

When you install an I-R pump, you can count on continued efficient operation—with a minimum of time out for attention and maintenance.

In addition to the pumps shown, Ingersoll-Rand manufactures a complete line of single and multi-stage pumps of horizontal and vertical design for every job application. See your I-R representative for full information on the pump which best meets your needs.

1. MOTORPUMPS: Free from base plates, couplings and alignment problems, I-R Motorpumps can be mounted in any position that gives the simplest, most economical installation. They are especially designed for continuous full load service, with a wide range of capacities from 5 to 1800 gpm and heads up to 600 ft. Available in single, two and four-stage units.

2. CRADLE-MOUNTED PUMPS: Built with separate pump and drive units, coupled and mounted on a sturdy base plate, I-R Cradle-Mounted Pumps come in one and two stages, with capacities from 5 to 2800 gpm and heads up to 525 ft. They can be equipped with any drive, and provide easier accessibility, over-sized bearings and greater accessibility.

3. SINGLE-STAGE HORIZONTALLY-SPLIT PUMPS, with double mechanical shaft seals: For capacities from 275 to 2400 gpm and heads to 350 ft., maintenance-free DMV and DHV pumps are provided with double mechanical shaft-seals and permanently lubricated sealed bearings. Troublesome stuffing box maintenance is eliminated, and bearings do not require any attention or lubrication throughout the life of the pump.

4. SINGLE-STAGE HORIZONTALLY-SPLIT PUMPS, conventional design: The Class AFV unit illustrated is typical of the standard I-R line of single-stage horizontally-split centrifugals, with capacities ranging from 25 to 50,000 gpm, and heads from 20 to 350 ft. Stuffing boxes are extra deep, and equipped with water seal cages. Any type of drive may be used.

5. TWO-STAGE HORIZONTALLY-SPLIT PUMPS: I-R two-stage Class GT pumps are available in capacities up to 2200 gpm for discharge heads up to 1050 ft. Outstanding performance is assured by such features as extra deep stuffing boxes, renewable shaft sleeves and wearing rings, carefully designed liquid passages and volutes, and efficient closed-type impellers.

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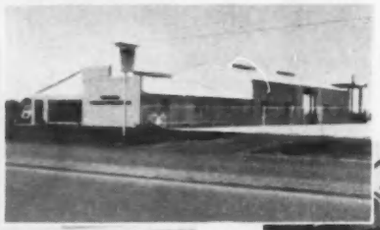


One of the 13 modern Waukesha Sales & Service, Inc., Sales and Service Stores.

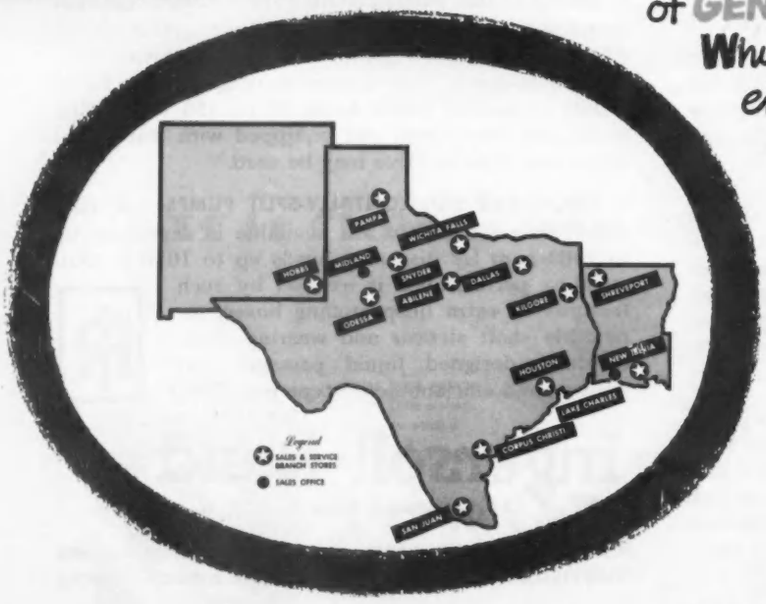
Complete repair facilities in a typical Sales and Service Shop.

Only at Waukesha Sales & Service, Inc., are you assured of getting genuine Waukesha parts.

Complete stocks of parts at all Sales and Service Stores.

At Waukesha Sales & Service, Inc. you get a professional repair job. Every one of Waukesha's thirteen branches gives you fast efficient service with modern equipment, factory trained mechanics and complete stocks of GENUINE Waukesha parts.

Why take a chance? Send your engine home to Waukesha Sales & Service, Inc. and get the job done right.



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EXCLUSIVE DISTRIBUTORS FOR WAUKESHA PRODUCTS IN TEXAS, NORTH AND WESTERN LOUISIANA, SOUTHERN ARKANSAS AND NEW MEXICO

WORLD'S LARGEST DISTRIBUTOR OF OIL FIELD ENGINES

AMCOT

American is everywhere

From the Canadian muskeg to the Gulf Coast . . . from California to Cairo . . . *American is everywhere!* American pumping units are in action the world over, giving top performance and economy of operation. American offices and dealers are conveniently located in all active oil areas . . . your assurance of on-the-spot service.

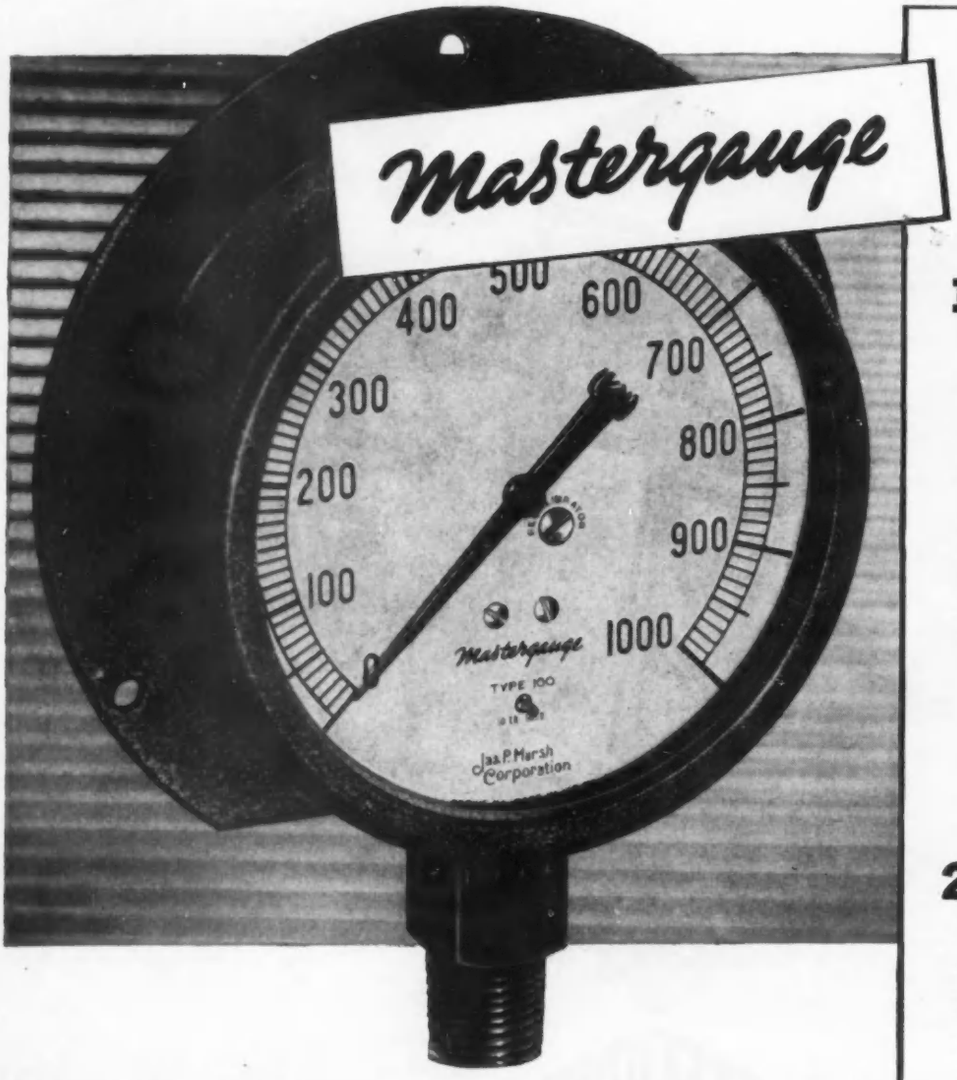
The AMCOT trade mark is your symbol of equipment built and backed by 32 years of manufacture-design know-how and experience. This built-in quality is your guarantee of the finest field-proven equipment . . . minimum maintenance and long life products which mean more money saved.

Contact your nearest American office or supply store for complete information . . . *American is everywhere.*

For better service, buy the best . . . buy American.

AMERICAN MANUFACTURING CO. OF TEXAS
P. O. BOX 7037 • FORT WORTH

WICHITA FALLS • ODESSA • HOUSTON • KILGORE • TULSA • SHREVEPORT • WICHITA • MT. VERNON, ILL. • CASPER • LOS ANGELES • NEW YORK • CALGARY



The leader has lengthened its lead!

From the day it was announced, the Marsh Mastergauge took the lead in the pressure gauge field. You are probably well aware of this . . . but do you realize that we have constantly given it plus qualities to still further *lengthen* its lead?

Look at the recent developments presented opposite. Unquestionably these are the three greatest strides in gauge development since the creation of the Marsh "Recalibrator."

Yes, the three basic gauge components have been brought to a remarkable stage of perfection in the Mastergauge. Certainly, for every critical service there is no gauge to compare with it!

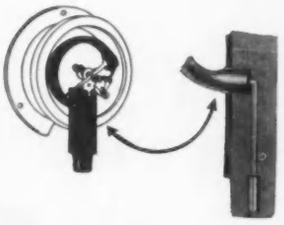
Mastergauge is standard bearer for the world's broadest line of gauges and dial thermometers, each the best of their kind in the applications for which they are recommended. Ask for data covering your specific needs.

MARSH INSTRUMENT CO. *Sales Affiliate of Jas. P. Marsh Corporation* Dept. K, Skokie, Ill.
Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta

ONLY MARSH HAS THE "RECALIBRATOR"

MARSH

THE STANDARD OF ACCURACY

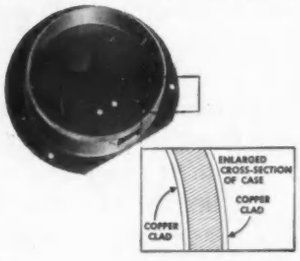


1—A better tube construction—

The Mastergauge always had the most effective joining of the bourdon tube to the socket . . . but . . . *one-piece construction is always better!* Welding these dissimilar parts posed a tough problem . . . but we finally solved it by a new process—the "Conoweld" process—exclusively ours. The photo of an actual section shows the perfect fusion. Socket, tube—even the end-piece—are fused into one leak-tight unit.

2—A better movement—

To convert the action of the bourdon tube into accurate pressure indication, the gauge movement must be rugged, practically frictionless, highly resistant to corrosion. A self-lubricating effect is achieved in the Mastergauge movement by using alternate stainless steel and monel—gears stainless, bushings "K" monel, and so on. A distinguishing feature is the "coined" sector gear. Note broad face of gear which results from this coined extrusion.



3—A better case—

Another development that has increased Mastergauge leadership is the new copper-clad, wrought steel case. The case has the strength of steel and the resistance to corrosion of copper. It is four times as strong as a cast iron case and one-third lighter. Final finish is a handsome corrosion resistant black enamel. Every case is fitted with Marsh safety blow-out plug—a typical advancement.

THE BEST DUAL COMPLETION

BROWN DS-8

"both packers fully retrievable"

"top packer can be pulled independently of bottom packer"

BROWN RS-1

"the RS-1 can be run and set- then pull out of it, go back in & retrieve it"

BROWN OIL TOOLS, INC.
2214 CAMPBELL ST.
HOUSTON, TEXAS

DUAL STRING PACKER

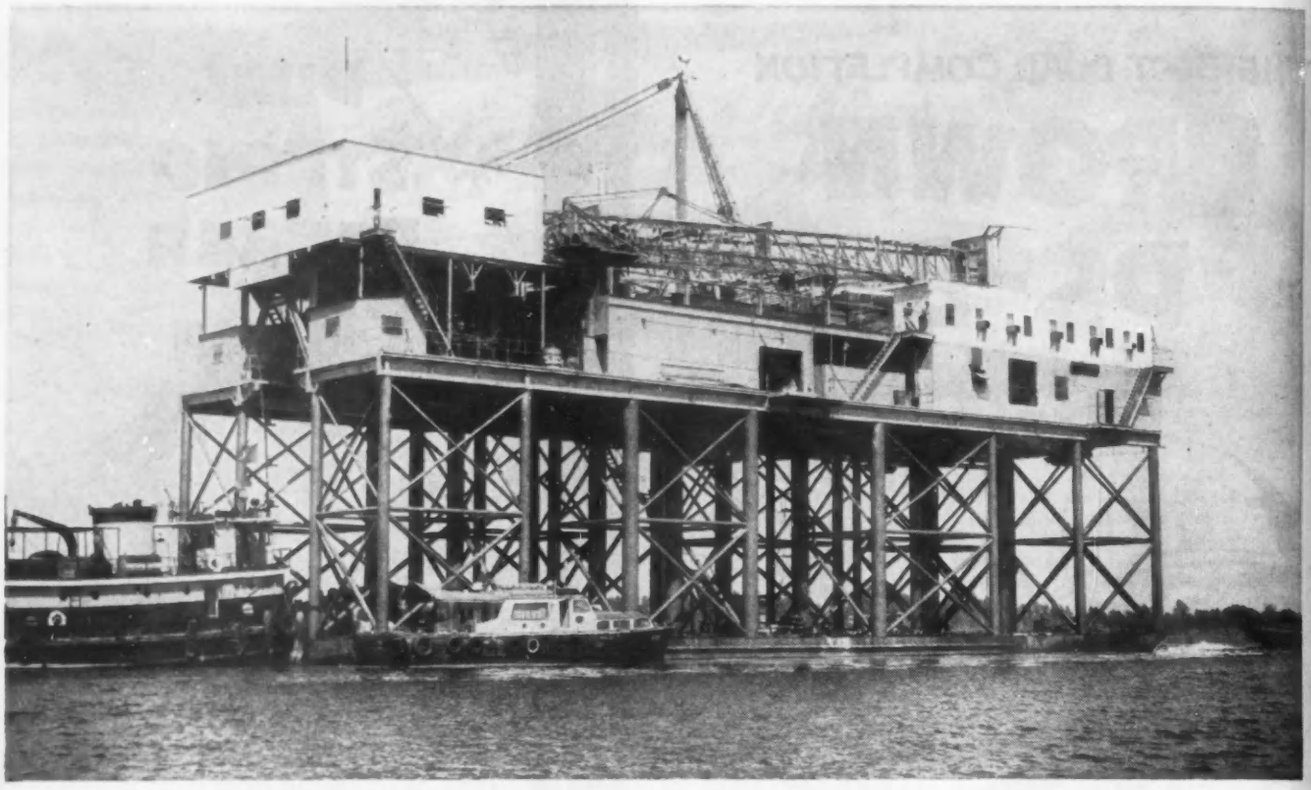
"runs both packers simultaneously"

"saves time- saves money!"

For further information, write: Brown Oil Tools, Inc.

BOT

IF YOU HAVE A PACKER PROBLEM — BROWN CAN HELP



Another for Odeco by American Marine!

ST. LOUIS TO JOIN CELEBRATED MR. CHARLIE AND JOHN HAYWARD

The third deep-water drilling barge that American Marine Corporation has designed and built for Odeco is shown above and at left on American Marine Corporation's huge capacity drydock for final outfitting prior to delivery. The new "St. Louis" is virtually an exact copy of the John Hayward, both patterned after the first of the greats, Mr. Charlie.

The St. Louis is an integrated submersible two story unit 180' x 120' with helicopter deck and air conditioned living quarters for 40 men. Drilling capacity is to 18,000 feet in 30 feet of water.

AMERICAN MARINE CORPORATION

FORMERLY ALEXANDER SHIPYARD

P. O. BOX 8126 NEW ORLEANS, LA. VAlley 2408

PIONEERS IN OFFSHORE DESIGN AND CONSTRUCTION !

The "Cone Nebula" in the constellation of Monocerus photographed through the 200-inch Hale telescope of the Palomar Observatory. This mass of stars is about 1,000 light-years, or roughly six million billion miles from the earth.

MEASURING THE UNSEEN

Although attempting nothing so spectacular as measuring unseen stars through a 200-inch telescope, Tuboscope research is paying off for oil men everywhere. From Tuboscope research have come new instruments for measuring the nearly unseen effects of wear, fatigue, and corrosion in oilfield tubular goods. And from Tuboscope experience in the field comes the ability to inspect and to grade your tubular goods with the greatest possible precision and with the least chance for human error. The important factors of bottom hole pressure and temperature are measured by Tuboscope's Subsurface Engineering Division.

2919 HOLMES RD. • HOUSTON, TEXAS

Tuboscope COMPANY

When you invest

...Specify National Seamless Oil Country Tubular Products. In oil fields throughout the world, you'll find USS NATIONAL Seamless Drill Pipe, Casing and Tubing constantly on the job, safeguarding production. Rough and ready to be worked hard, and ready to meet the higher stresses of drilling deeper holes tomorrow.

These NATIONAL Seamless Oil Country Tubular Products are known the world over for their outstanding service record in deep-well work. The secret of their strength and dependability may be attributed to two things —quality steel and a unique method of manufacture. Each seamless tube is pierced from a solid billet of steel. And only steel of the very best forging properties and of the highest uniformity can be used, since the piercing operation tends to search out any defects in the metal.

Thus, NATIONAL Seamless Oil Country Tubular Products are built to take the worst that oil well drilling has to offer—*built to give you more service and better service for every dollar you invest.* Remember *that,* the next time you order drill pipe, casing, or tubing.

SOME SIGNIFICANT DEVELOPMENTS BY NATIONAL TUBE...

NATIONAL DEOXIDIZED BESSEMER STEEL CASING AND TUBING—GRADES H-40, J-55 —Especially well-suited for oil production because of its combination of high yield strength and good ductility.

NATIONAL WARM-WORKED CASING — GRADE N-80 — An extremely high-strength casing possessing a uniformity of physical properties which gives it high collapse resistance and greatly increased joint strength. Hydrostatically tested to 80% minimum yield strength up to a maximum of 10,000 psi.

NATIONAL DEEP-WELL CASING— A stronger casing than is provided under A.P.I. specifications, to meet constantly increasing depths. Due to the severe service for which it is intended, it is hydrostatically tested to 80% of minimum yield strength up to a maximum of 12,000 psi.

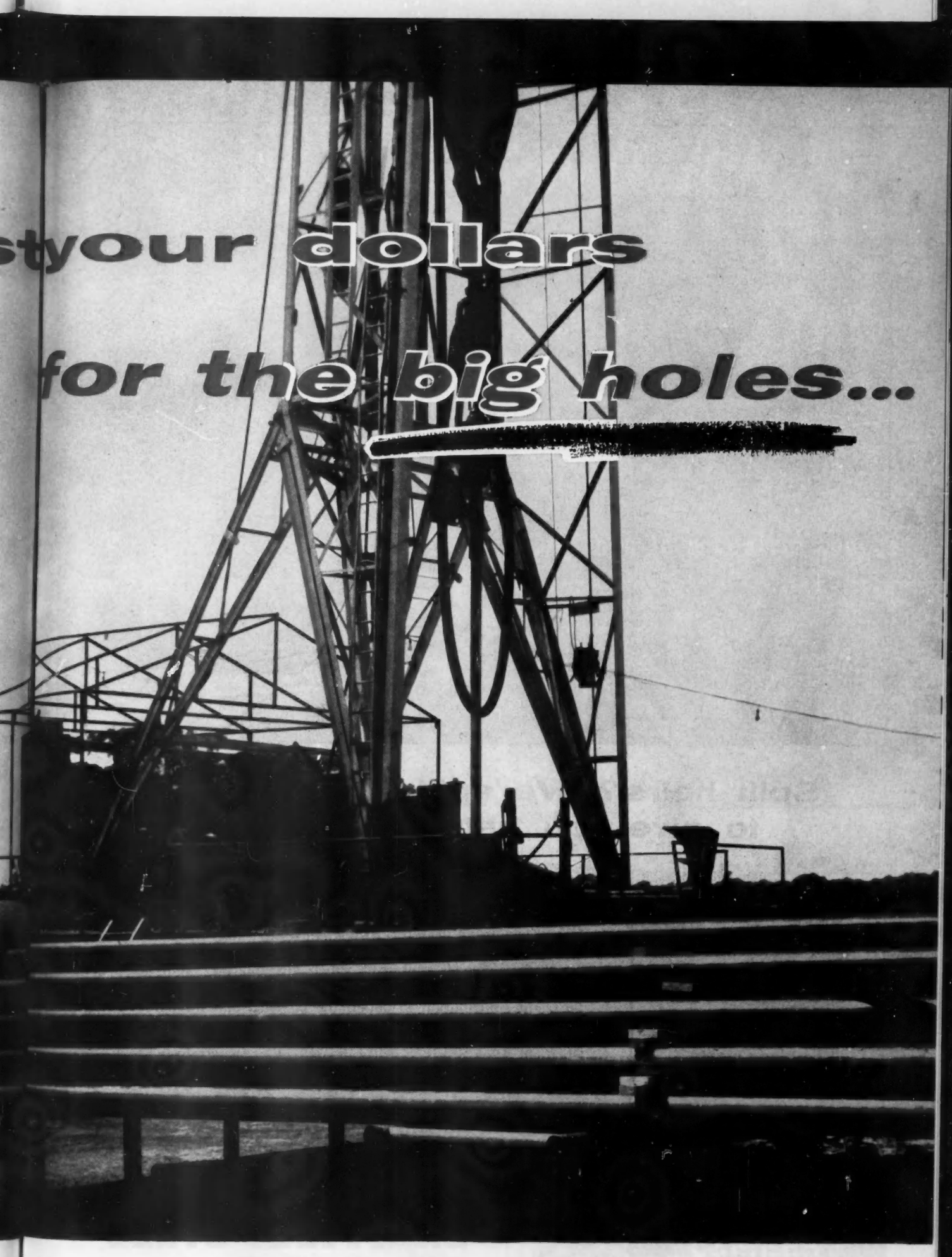
NATIONAL (B) BUTTRESS-THREAD —Developed to satisfy the need for a casing joint which will safely and economically support the weight of deep-well casing. The buttress-thread joint is comparable in strength to that of the body of the pipe.

For further information, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa. Ask for Bulletin No. 15.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

SEE The United States Steel Hour. Televised alternate weeks. Consult your local newspaper for time and station.

UNITED STATES STEEL



NATIONAL USS SEAMLESS

DRILL PIPE . . . CASING . . . TUBING

UNITED STATES STEEL

Split hairs? We split "spider webs" to give you better alloy steels

SHEFFIELD
ARMCO

High Strength
•
Shef-Ten
•
Forging Quality
•
Aircraft Quality
ALLOY STEELS

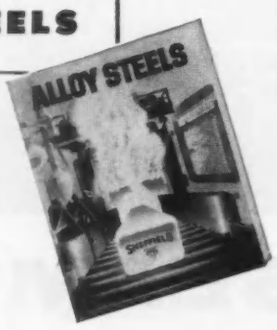
Accuracy is measured right down to the millionth part in the making of Sheffield Alloy Steel.

Here a technician measures with a densitometer the exact quantity of each element in a furnace sample. This unit provides a double check on other production control equipment which electronically analyzes each heat. Each alloying element, no matter how minute the quantity, must make the right contribution to obtain the physical and mechanical properties required for each particular end use.

Sheffield Alloy Steels in drill bits and collars penetrate the rock strata of the earth. In aircraft and guided missiles, they pierce the stratosphere.

As a manufacturer of just about any product using alloy steels, you'll find the metal tailored to your needs in Sheffield High Strength, Shef-Ten, Forging and Aircraft Grades. Get in touch with us.

Get your copy of "ALLOY STEELS"
If you're a manufacturer or otherwise engaged in industries served by alloy steels, write for your free copy of the Sheffield ALLOY STEELS book.



SHEFFIELD STEEL
DIVISION
ARMCO STEEL CORPORATION
SHEFFIELD PLANTS: HOUSTON • KANSAS CITY • TULSA

IT'S REVOLUTIONARY

FOR METERING, TESTING SAMPLING, MANIFOLDING

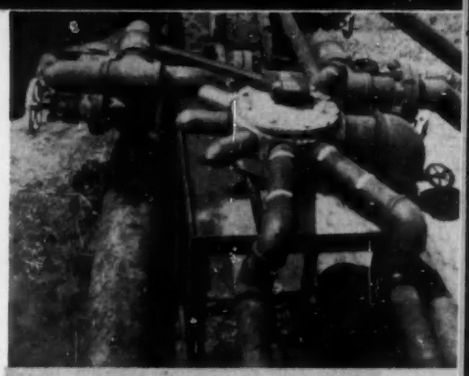
Win Well 7-WAY

MULTI-PORT ROTARY SELECTOR VALVE

Brings as many as 7 different Pipe Lines to a central source

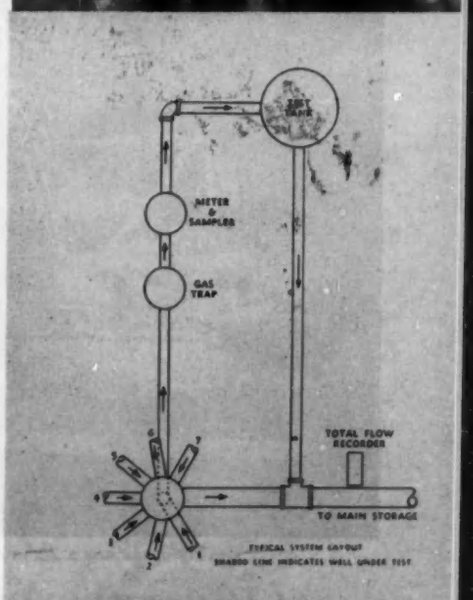
The Win-Well Selector Valve has caused a "minor revolution" in the thinking of engineers who are concerned with the control of bulk liquid flow, and it has enabled them to make radical changes in testing, metering and sampling — changes that have meant great economies.

Win-Well is a rotary valve with 9 ports adapted to connect as many as 7 input lines to a single output line, and one auxiliary output line. For instance, any one of the input lines can be connected with the auxiliary output line as oil is being joined into a common supply line for transmission to storage tanks or other locations.



TEFLON BUSHINGS MEAN TROUBLE-FREE OPERATION

With only one moving part — the rotating element or selector body — the bearing surfaces at the top and bottom of the selector, as well as the face that seats against the port faces of the Win-Well Valve, are made of Teflon — highly resistant to abrasion, corrosion and maximum high and low temperatures. Win-Well's unique design effects extremely tight seals *with no leakage,* even under low pressure service. (Service rating: 150# Valve — Non-shock rating continues flow of water, oil or gas — 600#)



A MUST FOR OIL PRODUCTION AUTOMATION

The adaptability and application of the Win-Well Valve to systems of automation in oil production are limitless. Electric controls, especially designed for automation, are available from Win-Well, and similar systems have been developed for pneumatic and gas controls — offering an immediate and practical solution to automatic fluid control.

FIELD TESTED AND PROVED

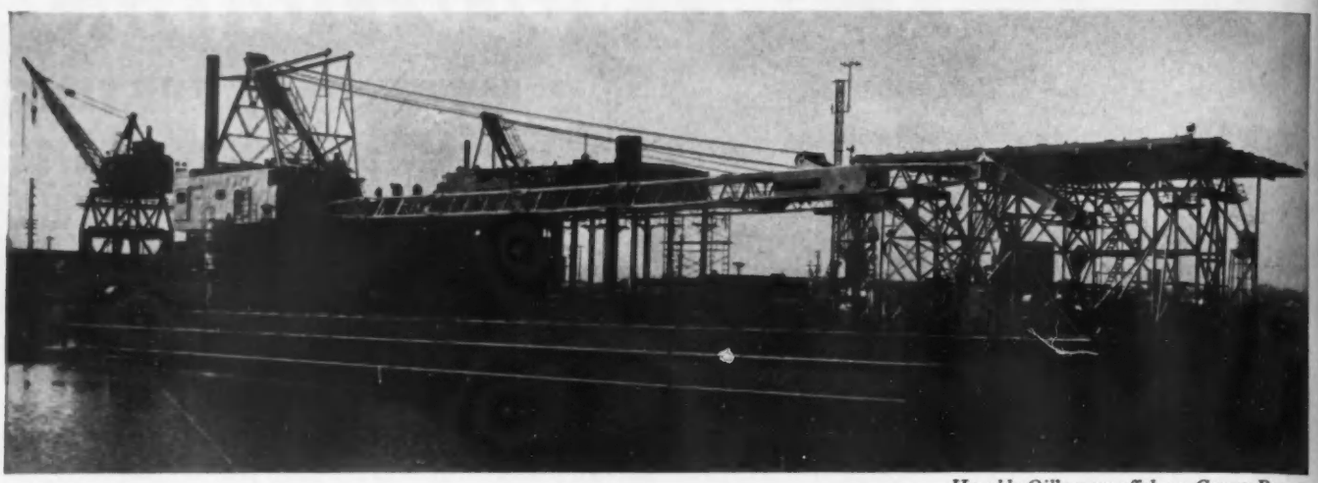
After 8 months operation in the field, under the most demanding conditions, the Win-Well Valve underwent rigid, microscopic laboratory tests. The report of these tests proved Win-Well's rugged dependability, a copy of the report is available to you upon request.

A Win-Well representative will gladly discuss the valve's potential for your fluid control use.

Win Well Manufacturing Company

8460 West Third St. Los Angeles 48, Calif.

BETHLEHEM AT BEAUMONT



Humble Oil's new offshore Crane Barge.

New Heavy-Lift Derrick Barge for Offshore Operations

The big crane has a 250-ton capacity.

Humble Oil & Refining Company's new Derrick Barge, "DB-1," was designed to facilitate deep-water oil drilling operations. 300 ft long, 90 ft wide and 19 ft 1-in. in depth, the craft has two revolving cranes mounted on the main deck, one of 250 tons capacity and the other of 40 tons. It is equipped with electric generators, steam boilers, welding apparatus, various construction tools and all necessary deck machinery for mooring. The craft also has a two-level construction foreman's office, an elevated helicopter landing platform and comfortable, air-conditioned crew's quarters for 58 men.

Constructed and equipped by Bethlehem at Beaumont, the "DB-1" is an excellent example of the specialized craft designed and built by this yard for the oil industry.

If you have an offshore problem your *best bet all ways* is Bethlehem at Beaumont. Your inquiries are invited.

A close-up of the two revolving cranes. The smaller unit has a 40-ton capacity.

SHIP REPAIR YARDS

Boston Harbor — New York Harbor
Baltimore Harbor — Beaumont, Texas
Los Angeles Harbor — San Francisco Harbor

SHIPBUILDING YARDS

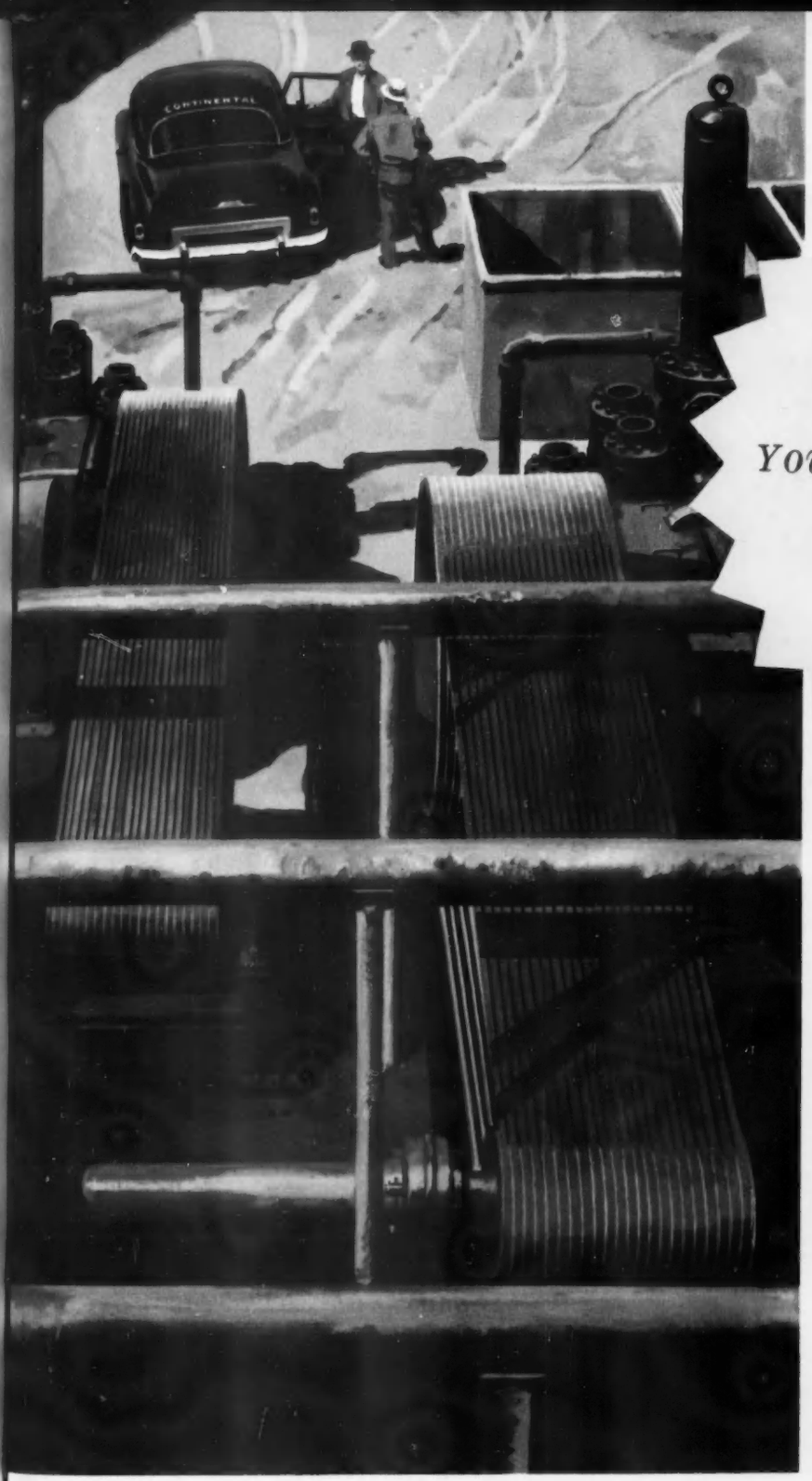
Quincy, Mass. — Staten Island, N. Y.
Sparrows Point, Md. — Beaumont, Texas
Terminal Island, Calif. — San Francisco, Calif.

BETHLEHEM STEEL

Shipbuilding Division

GENERAL OFFICES: 25 BROADWAY, NEW YORK 4, N. Y.

On the Pacific Coast shipbuilding and ship repairing are performed by the Shipbuilding Division of Bethlehem Pacific Coast Steel Corporation



TO RIG-UP OR REPLACE

You can save money with

TEST SPECIAL V-BELTS

Made by New York Belting and Packing Company, America's oldest manufacturer of mechanical rubber goods, Test Special V-Belts have the reputation for consistent quality and performance. Too, Test Special V-Belts, in all sizes, are readily available *in matched sets,* at all Continental Stores.

Ready availability plus longer life results in operating economy.

Whether you're rigging up or replacing — your conveniently located Continental Store has in stock the belts you need.

CONTINENTAL

Serving the Oil and Gas Industries

NEW YORK BELTING & PACKING CO. • Founded 1846

CONTINENTAL SUPPLY COMPANY

A Division of The Youngstown Sheet and Tube Company

General Offices: DALLAS, TEXAS

Representatives in All Principal Oil Fields of the World

Out-of-stock service

Yellow Strand®

"POWERSTEEL" . . . Your convenient Continental Store maintains a complete stock of wire rope in all grades, sizes and constructions to take care of all your rope requirements. This extensive selection includes the new Yellow Strand "POWERSTEEL" . . . the outstanding achievement in wire rope construction. Its greater strength gives more ton-miles in service.

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Serving the Oil and Gas Industries

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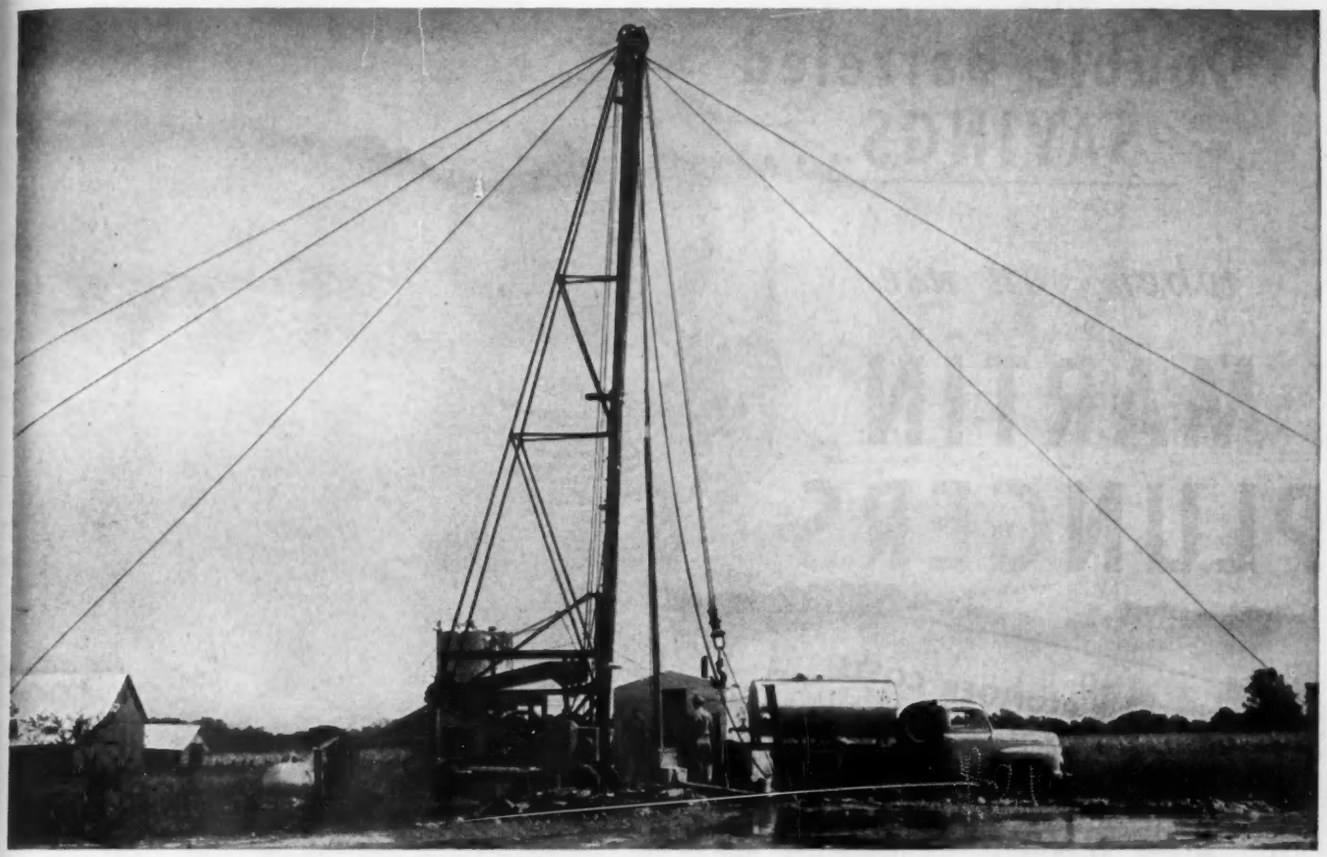
General Offices: DALLAS, TEXAS

Representatives in All Principal Oil Fields of the World

What's in it for YOU?



Steady, dependable performance . . . that's what you expect and get with a versatile Bucyrus-Erie spudder on your drilling and servicing operations. These modern mobile rigs speed top-to-bottom drilling, drilling-in, or the multiple jobs included under servicing and well completion. They are designed to assure pace-setting performance hole after hole with quick easy moves, and reduced costs all down the line. They are built to stand up to full-time diet of rugged duty.

Such outstanding dependability — the backbone of true satisfaction — is the result of Bucyrus-Erie's close attention to the little things through a skill born of pride and craftsmanship. At Bucyrus-Erie, *quality* comes FIRST — quality in design, in materials, in manufacture, in service.

60-L Top-to-bottom drilling to 1,500 ft.; Servicing to 2,000 ft.; Swings up to 2,750 lbs. of tools.

28-L Top-to-bottom drilling to 2,500 ft.; Servicing to 3,000 ft.; Swings up to 3,700 lbs. of tools.

36-L Top-to-bottom drilling to 3,500 ft.; Servicing to 4,000 ft.; Swings up to 5,000 lbs. of tools.

48-L Top-to-bottom drilling to 6,000 ft.; Servicing to 7,000 ft.; Swings up to 6,700 lbs. of tools.

Join the thousands of satisfied owners who know you can count on Bucyrus-Erie spudders to deliver top performance year after year. See your nearby Bucyrus-Erie distributor or write for complete information on any of these spudders. Do it soon. 32556

Quality in the making: Ruggedness and durability are built into the frames and derricks of Bucyrus-Erie spudders through use of most modern electric welding techniques.

BUCYRUS ERIE

SOUTH MILWAUKEE
WISCONSIN

Double-Barreled SAVINGS . . .

when you use

MARTIN PLUNGERS

1 SAVE ON PLUNGER COSTS

One Martin Plunger will make many long runs, with only the rings being replaced. A set of rings costs only one fourth as much as a new plunger. Thus it is easy to figure the savings on the plunger alone.

2 SAVE ON BARREL COSTS

Metal to metal wear is eliminated. The resilient rubber & duck rings are so much easier on the barrel surface that barrels usually last several times longer. Here too is an important item in pump costs.

MORE BARRELS IN THE TANK TOO

because of better seal, freer travel in the barrel and longer runs. AVAILABLE for your pump and your well, regardless of diameter, or depth or well condition. Get catalog No. 4 and read how to make selection and installation.

MARTIN PLUNGERS ARE SOLD THRU SUPPLY COMPANIES

JOHN N. MARTIN

Manufacturer

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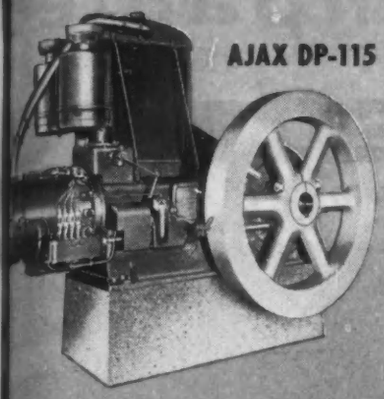
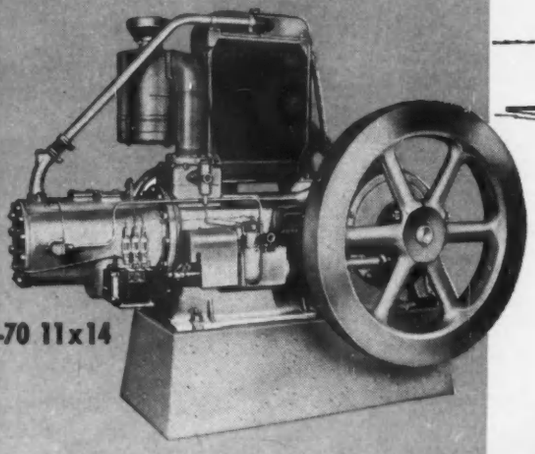
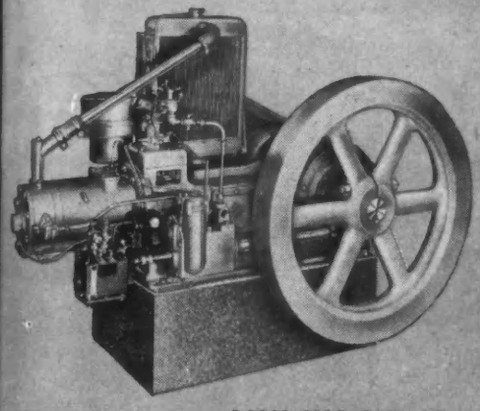


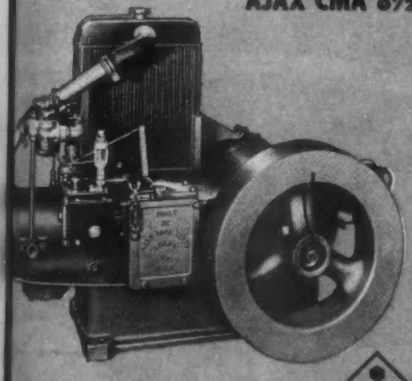
AJAX DP-115 13¼x16



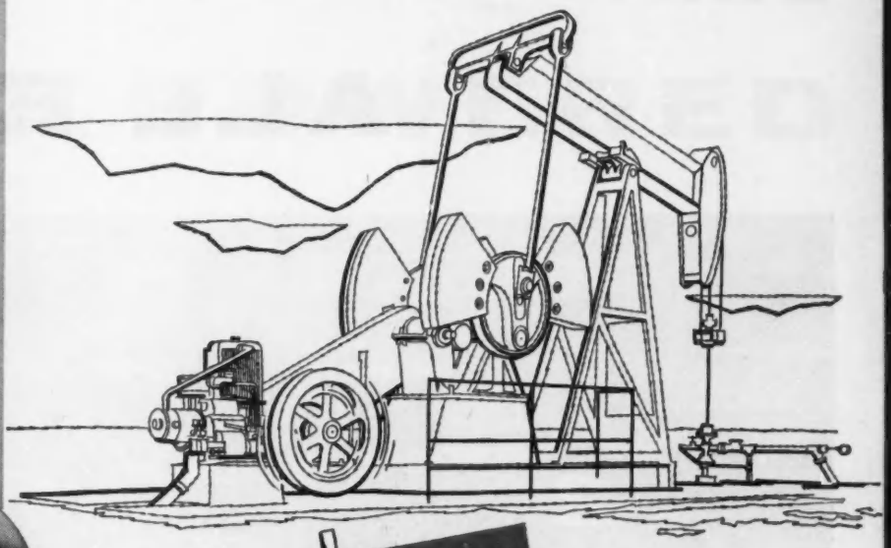
X DP-70 11x14



AJAX CMA 8½x10



AJAX WL 5x6½



you get

Cheap Power

with QUALITY GAS ENGINES

by *Ajax*

CHEAP POWER makes money for you . . . costly power drains it away. You can figure your savings with AJAX AND GAS in terms of gas vs. purchased power costs in *your* locality—delivered to *your* wells—consumed on *your* jobs. (Or send us the data and we'll do the work!) • When you see the solid money difference, see your Supply Man, fast!

AJAX IRON WORKS

Builders of GAS AND OIL ENGINES, PRESSURE PUMPS, STEAM DRILLING ENGINES, INDUSTRIAL STEAM ENGINES

CORRY, PENNSYLVANIA

Oil Field Distributors: THE NATIONAL SUPPLY CO., PITTSBURGH, PA.
R. B. MOORE SUPPLY CO., BOLIVAR, N.Y. • BETHLEHEM SUPPLY CO., TULSA, OKLAHOMA

Six Rigs—Four Companies—

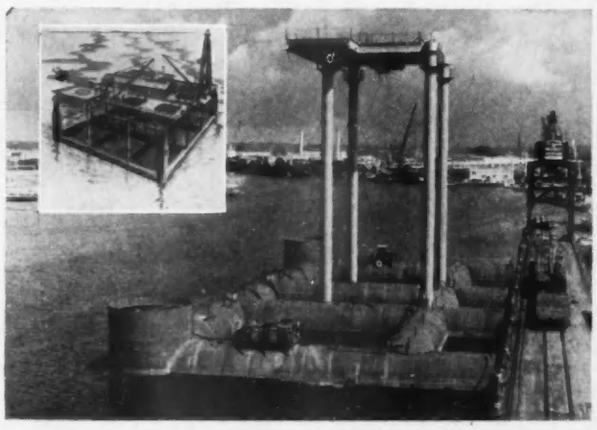
ALL ELECTRO-

—All Diesel-Electric...and

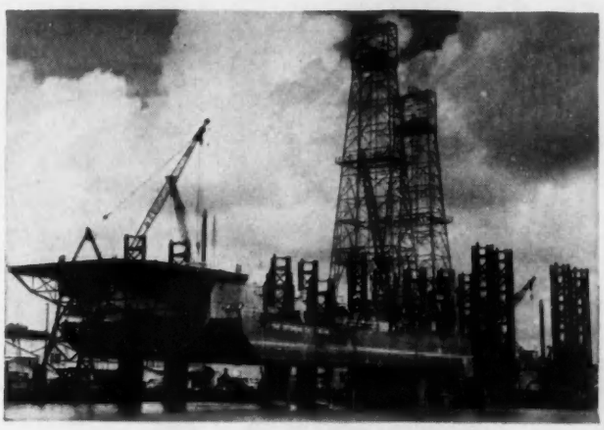
-MOTIVE POWERED

We had this aerial view of the yards at Orange, Texas, taken for just one reason. It tells more literally than words how Electro-Motive Power is being accepted in the drilling industry everywhere. In this one photograph, there are six offshore drilling platforms or tenders in various stages of construction for four different concerns. All have one major thing in common: *each is equipped with Electro-Motive Diesel-Electric Power.*

For drilling over land or water it will pay you to investigate the flexibility, control and economy of Electro-Motive Power—the new standard for deep drilling applications. Contact your Electro-Motive representative for complete details.

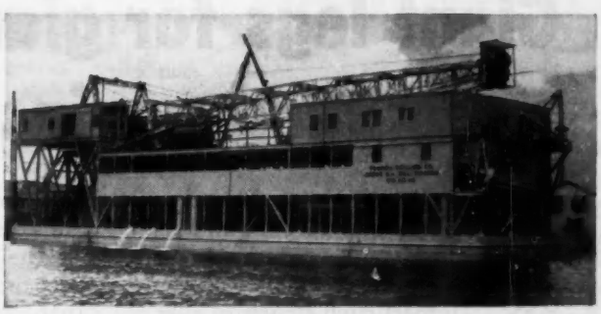


1 Shown here is Kerr-McGee's Rig No. 47, a mobile type of drilling device under construction by American Bridge Division of U. S. Steel. Three Electro-Motive Power units will be located on the rig, supplying power for mud pumps, drawworks and rotary table. Due for completion late this year, the drilling device brings to three the number of Electro-Motive Powered rigs for Kerr-McGee.



2 Rigs No. 54 and 55 for Offshore Company are shown here nearing completion in the American Bridge yards of U. S. Steel Corp. These mobile drilling barges, each powered by three 875 hp. Electro-Motive Power units, are capable of operating in waters up to 100 feet in depth. Each barge measures 200 feet long and 104 feet wide and contains eight hydraulically operated, 225-foot supporting legs.

3 This tender, one of four being converted for a major oil company, is shown at the Levingston yards at Orange. A former LST, the tender features a heliport and is completely outfitted with modern eating, sleeping and recreation facilities for the crew. Two 12-cylinder Electro-Motive Power units rated at 1200 hp. each will be located in the tenders as the power source for large mud pumps.

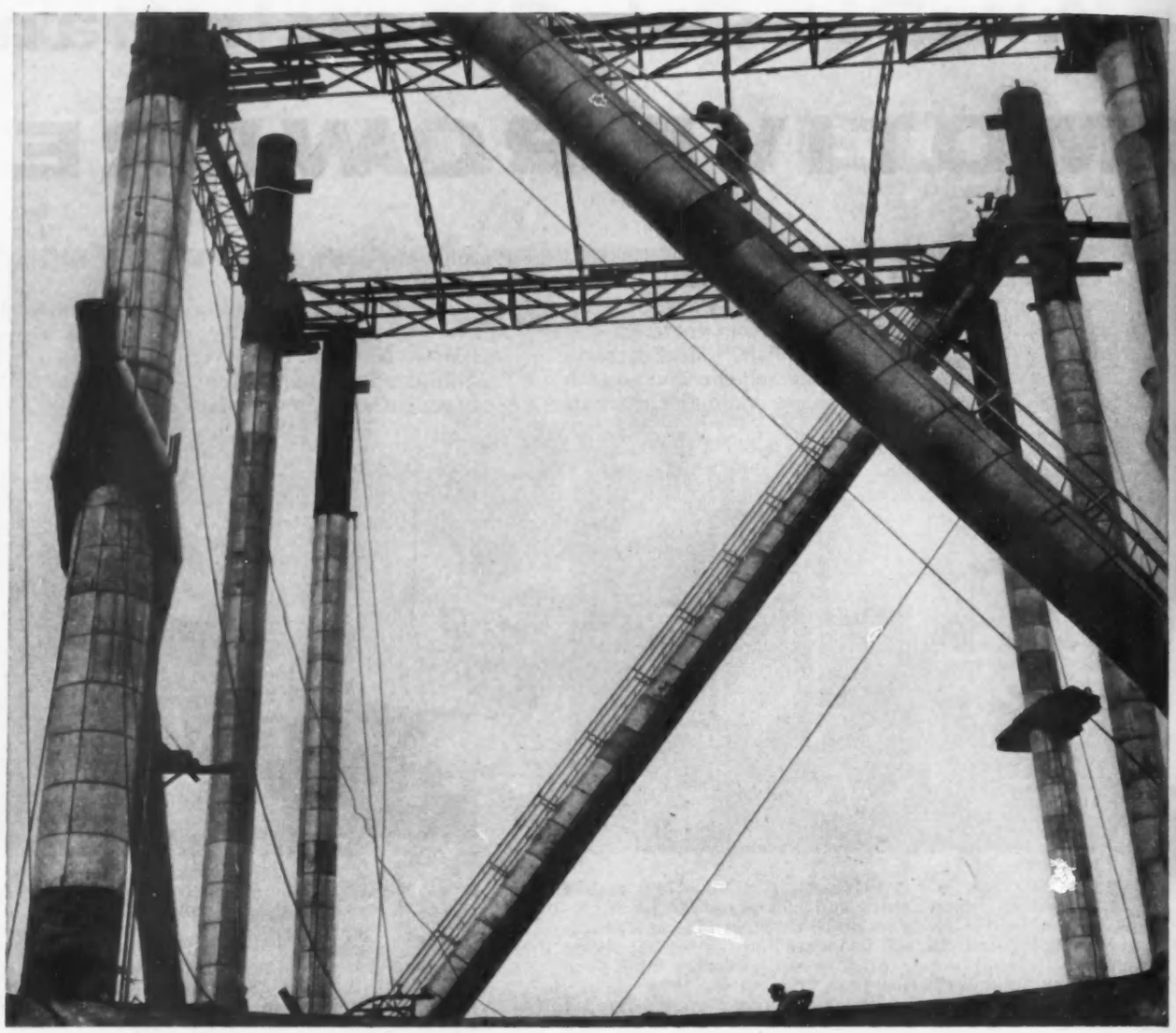


4 The Penrod Drilling Company's W. H. (Bill) Dordan, a submersible island drilling barge, powered by 3 Electro-Motive units, is one of two recently christened. Built by Levingston, the Dordan is now drilling for Placid Oil Company. The second Electro-Motive powered barge, the Tom Sorrell, is also completed and drilling for Placid Oil. Both these barges are capable of drilling 18,000 feet in 19 feet of water.

ELECTRO-MOTIVE DIVISION · GENERAL MOTORS

LA GRANGE, ILLINOIS *In Canada:* General Motors Diesel Limited, London, Ontario

Petroleum Industry sales offices: Tulsa, Oklahoma; Houston, Texas; Dallas, Texas; Morgan City, Louisiana; Pasadena, California



Giant legs for giant seagoing rig . . . sheathed against corrosion with Monel

These are the legs of a ten-story-high seagoing drilling rig shown during construction in the yards of Avondale Marine Ways. It is the S-55 . . . largest such structure ever launched at New Orleans.

The legs support a 190x150-foot elevated deck drilling barge . . . complete with crew quarters, gear, heavy machinery, 140-foot derrick.

They also take the brunt of the sea's constant attack . . . smashing waves, battering from floating equipment, the bite of corrosion.

Monel sheaths shield steel in 65-foot critical zone

The rig is sunk to bearing in waters 45 to 50 feet deep. Over all, some 65 feet of supporting structure may be exposed to splash corrosion . . . the kind most harmful to steel . . . where neither paints nor sacrificial anodes provide adequate protection.

In this critical 65-foot zone, welded 0.031-inch Monel* nickel-copper alloy sheathing covers and protects every square inch of the legs.

Monel alloy has proved by far the most practical way to control splash corrosion. It has been used on offshore drilling structures since 1949 and, more recently, on coastal radar "islands".

New developments in corrosion prevention come thick and fast. Before you finalize metal specs, talk them over with Inco's Development and Research Division.

*Registered trademark

Improve your selection of metals for petroleum production equipment. Write today for the Inco booklet, "Metals to Make Petroleum Production Equipment Produce More."

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

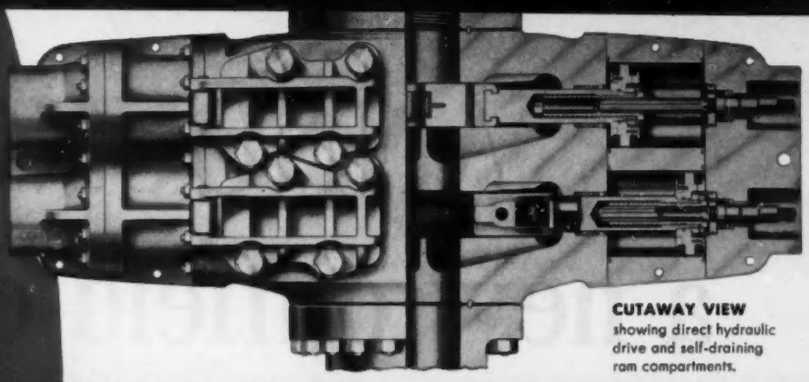
INCO TRADE MARK Nickel Alloys

Monel *". . . it's the Seagoin' metal"*

Monel and Seagoin' are registered trademarks of The International Nickel Company, Inc.

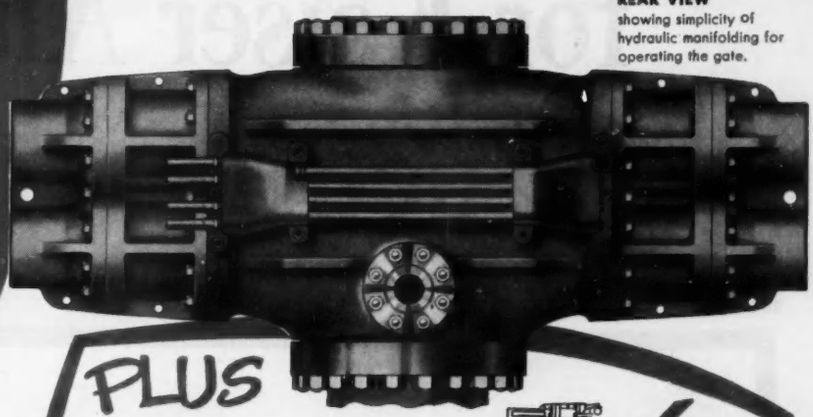
ONLY

Shaffer CONTROL GATES



CUTAWAY VIEW
showing direct hydraulic drive and self-draining ram compartments.

PACK SO MANY ADVANTAGES INTO SUCH COMPACTNESS!



REAR VIEW
showing simplicity of hydraulic manifolding for operating the gate.

...COMPACTNESS in a gate doesn't mean much if vital extra space must be allowed *above* the gate — or at the *ends* — in order to change rams. In Shaffer Hydraulic Gates the rams are changed through patented *side*-opening doors — doors that open across the *minimum* dimensions of the gate where there's plenty of space.

This means that the unusual compactness of Shaffer Gates is *completely useable* compactness. These gates fit into tight spaces too small to accommodate other equipment of comparable rating. Even in sizes as large as 13⅜" (12" Series 900) Shaffer *Double* Gates require a *total* height of only 30" — Single Gates only 18½" — with width and length dimensions also unusually compact.

But compactness is only *part* of the complete Shaffer story. Other vital advantages are outlined at right . . .

PLUS

...SAFETY!

In Shaffer Gates you get field-proven pressure protection backed by the organization that pioneered cellar control gates more than three decades ago, and year after year has steadily maintained its leadership with one basic advancement after another!

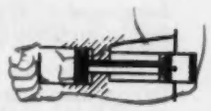
...ACCESSIBILITY!

With Shaffer Hydraulic Gates, rams are changed by simply unbolting convenient *side* doors, sliding out the ram assembly, changing rams, replacing the assembly and bolting the doors shut. And closing the doors automatically aligns the rams within the body!

What's more, with Shaffer Double Gates, there's no need to dismantle the upper unit to change rams in the lower unit—or vice versa. Each is completely independent — each has its own convenient side-opening doors. And each can be changed with equal ease whether the pipe is *in* or *out* of the hole!

...SELECTION!

Shaffer not only provides a complete choice of sizes and ratings to meet every requirement, but also such additional choices as *Single* or *Double* Gates (the latter with *two* ram compartments unitized into *one* compact body) . . . each design with choice of *Rising* or *Non-Rising* Locking Shafts, depending upon whether you prefer the quick indication of ram position provided by a *Rising* Shaft, or the greater compactness of a *Non-Rising* Shaft. YOU pick the particular arrangement *you* prefer!



...DIRECT DRIVE!

In Shaffer Gates the operating pistons are *directly behind* the rams for positive operation, fewer parts, greater simplicity. There are no complicated hook-ups, no exposed piston rods, no secondary connections between operating cylinders and rams!

33 years OF OIL TOOL LEADERSHIP

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops: Santa Fe Springs and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Shaffer Tool Works, 6201 South Shields Boulevard
FARMINGTON, NEW MEXICO, Shaffer Tool Works, Post Office Box 546
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 1788
EXPORT SALES OFFICE: Shaffer Tool Works, 500 Fifth Avenue, New York, N. Y., U. S. A.

The unsurpassed pressure protection provided by Shaffer Gates — coupled with their many unique *additional* advantages — make them the leading choice of oil operators everywhere. Take time to investigate how much more *your* pressure-control dollar buys when you specify SHAFFER. And if you are in the market for *mechanically*-operated gates, Shaffer can provide these, too, with advantages unsurpassed in their field. Call your nearest Shaffer representative for complete details . . . or write direct!

A copy of the Shaffer Catalog will gladly be sent on request!

See the Shaffer Section of your Composite Catalog!

ANNOUNCING
a new oilfield distributor for Kaiser Aluminum petroleum pipe

Republic Supply Company...
Dunigan Tool & Supply Company... and now—
another distributor to provide immediate delivery of Kaiser Aluminum Petroleum Pipe

Oil Well Supply
Division United States Steel Corporation

Three distributors can now supply you with high quality Kaiser Aluminum pipe in 20, 30 and 40-foot lengths of 2, 2½, 3 and 4-inch sizes, with cladded inside surfaces to resist corrosion.

Durable Kaiser Aluminum pipe is ten times lighter than schedule 40 steel pipe... 40 feet of the 4" aluminum pipe is easily handled by only one man.

Actual installations prove that because of its lightweight and easy handling, Kaiser Aluminum pipe will save you up to $84.35 per mile in loading, stringing and handling.

And, you get extra savings when you use economical Kaiser Aluminum pipe—with your choice of aluminum couplers—for rig supply line systems. The newly developed detachable couplers speed connecting and break-out time to give you an additional saving of about $135 per mile.

Remember, the *roll-formed* aluminum petroleum pipe available only from Kaiser Aluminum assures closer diameter and wall thickness tolerances—factors which every experienced pipeliner knows are so important for leak-proof coupler fit or welding line-up.

For immediate delivery from warehouse stocks or for more information, contact any distributor shown below; or, call the Kaiser Aluminum sales office listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office,* Palmolive Bldg., Chicago 11, Ill.; *Executive Office,* Kaiser Bldg., Oakland 12, California.

Kaiser Aluminum Petroleum Pipe

distributed by

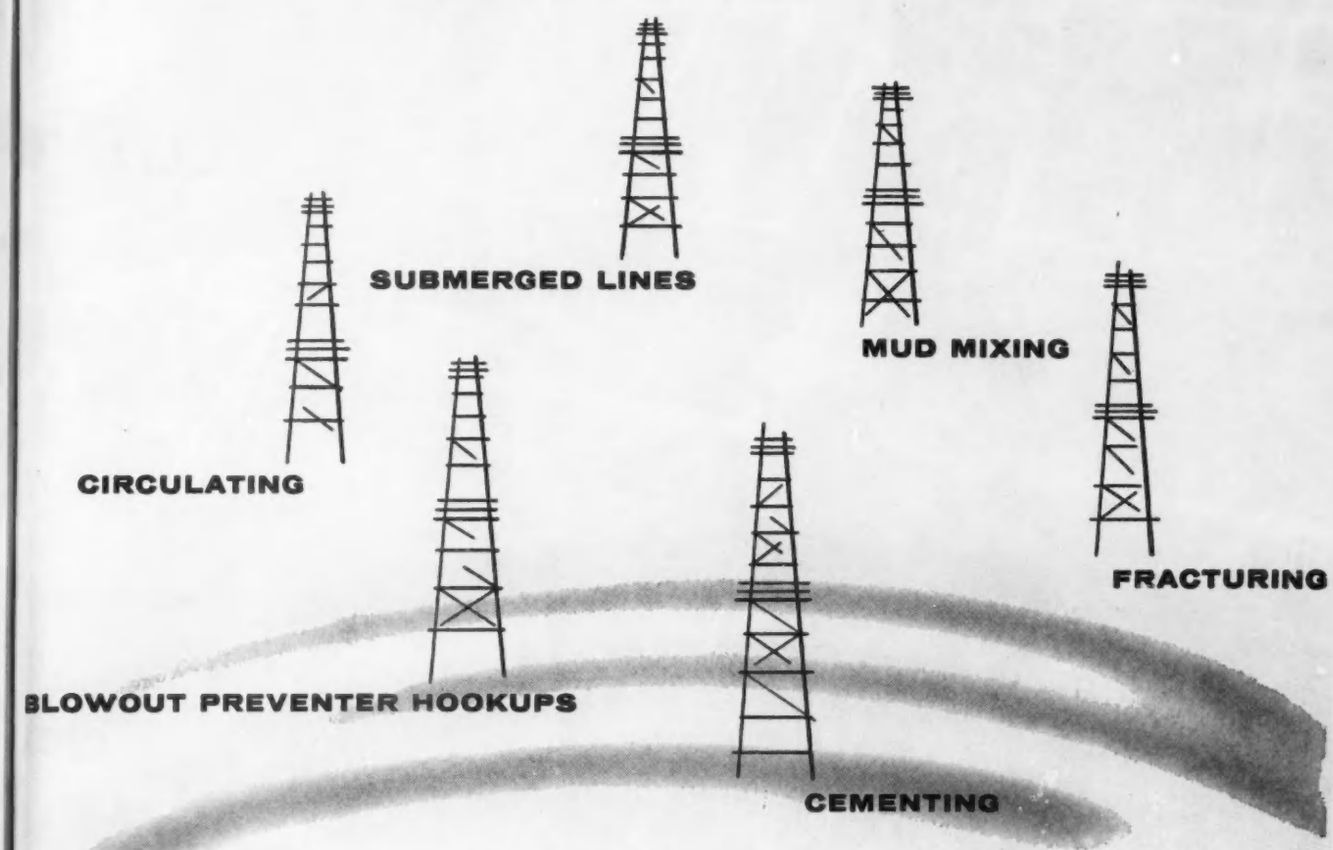
REPUBLIC SUPPLY COMPANY
Republic Building
Oklahoma City
Oklahoma

DUNIGAN TOOL & SUPPLY COMPANY
1534 South
Treadway
(Home Office)
Abilene, Texas

"Oilwell" OIL WELL SUPPLY
Division
United States
Steel Corporation
(Home Office)
Dallas, Texas

See "THE KAISER ALUMINUM HOUR." Alternate Tuesdays, NBC Network. Consult your local TV listing.

WHEREVER YOU FIND OIL...



YOU'LL FIND CHIKSAN

SWIVEL JOINTS

From rotary hose to submerged lines, on rigs all over the world, it's a safe bet you'll find Chiksan Swivel Joints in service. The reason for this is simple. Oilmen know from years of experience they can rely on Chiksan to deliver dependable performance under the most rugged conditions. They know too, that Chiksan Swivel Joints save rigging up time, prevent line vibration fatigue, permit flexibility in positioning pumps and tanks. Small wonder then that wherever you find oil, you'll find Chiksan Swivel Joints.

SOLD AT LEADING SUPPLY STORES EVERYWHERE

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

CHIKSAN

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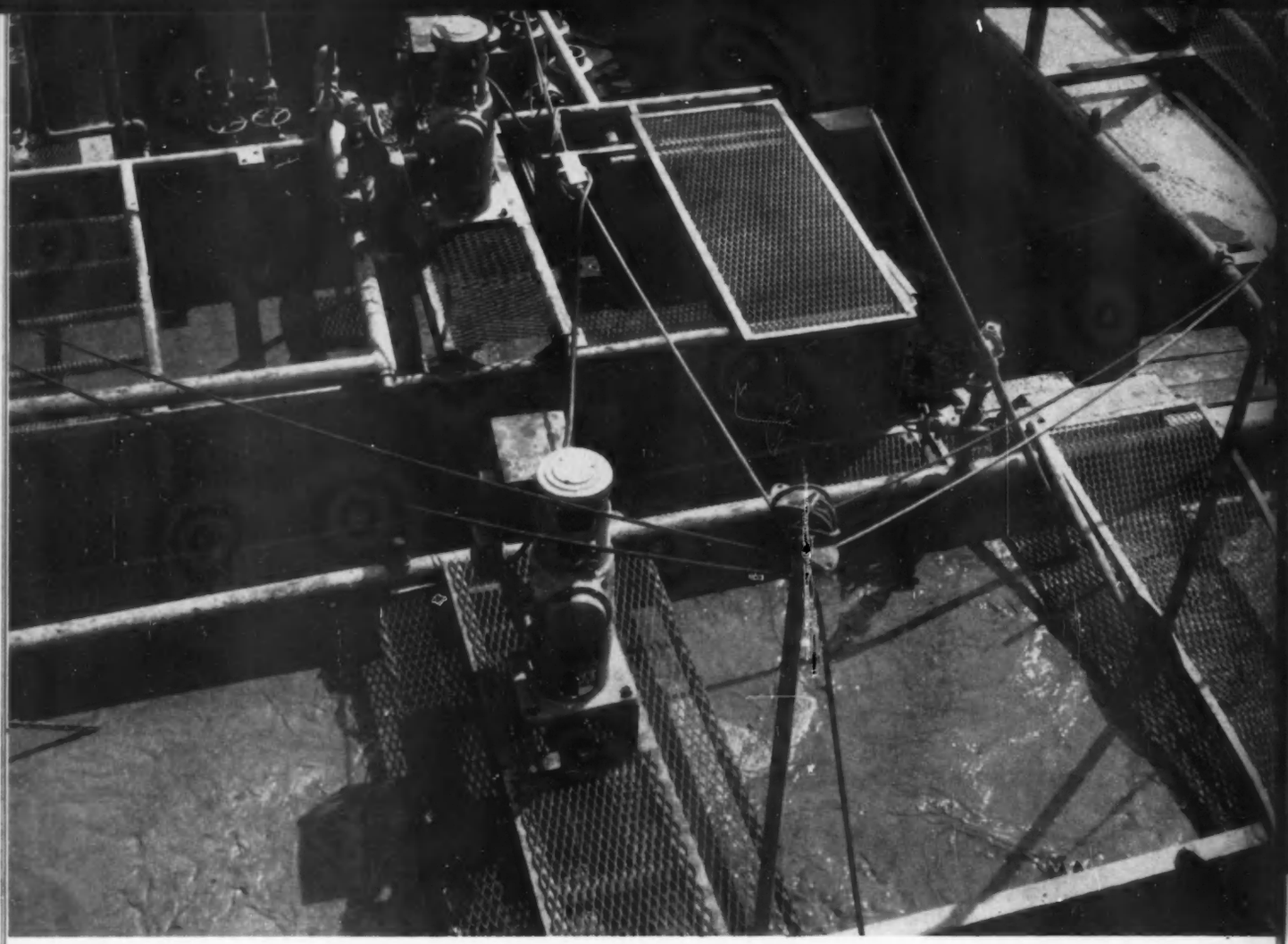
CHIKSAN COMPANY—BREA, CALIFORNIA • CHICAGO 5, ILLINOIS • NEWARK 2, NEW JERSEY

Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Subsidiaries: Chiksan Export Company • Chiksan of Canada, Ltd.



"...cuts the work of mixing mud *90 per cent*"

"SWEETEST THINGS I EVER SAW," says Mr. W. R. Morphis about the LIGHTNIN Mud Mixers installed on Shoreline Drilling Company's Rig No. 3. This rig is drilling for the Southern Natural Gas Company.

That statement comes from Tool Pusher W. R. Morphis. He's talking about the LIGHTNIN Mixers on Shoreline Drilling Company's Rig No. 3—located in the Plumb Bob Field, St. Martin Parish, Louisiana. One look at the mud flow in Shoreline's tanks (above) will tell you what's behind his statement.

You get uniform mud and *immediate* dispersion of gel additions with LIGHTNINs. In fact, you get the type of mud mixing that prompted Mr. Morphis to say:

" . . . sweetest things I ever saw. Cuts the work of mixing mud 90 per cent. No auxiliary mud pump necessary. Just keeps the mud all evenly mixed with practically no attention."

Ask the men who've used LIGHTNIN Mixers. They'll tell you there's no better way to get mud in condition and keep it there. With a LIGHTNIN Flash Mixer, you can increase the weight of every gallon of mud in the tank—by the exact amount you want —*in a few seconds.* Heavier, thicker mud is yours the moment you want it!

Seeing is believing

Your LIGHTNIN sales engineer will arrange a visit to a rig in your area where LIGHTNINs are at work. Look him up in the Composite Catalog. Tell him you want to see for yourself how LIGHTNINs can give you better mud control *for less money.*

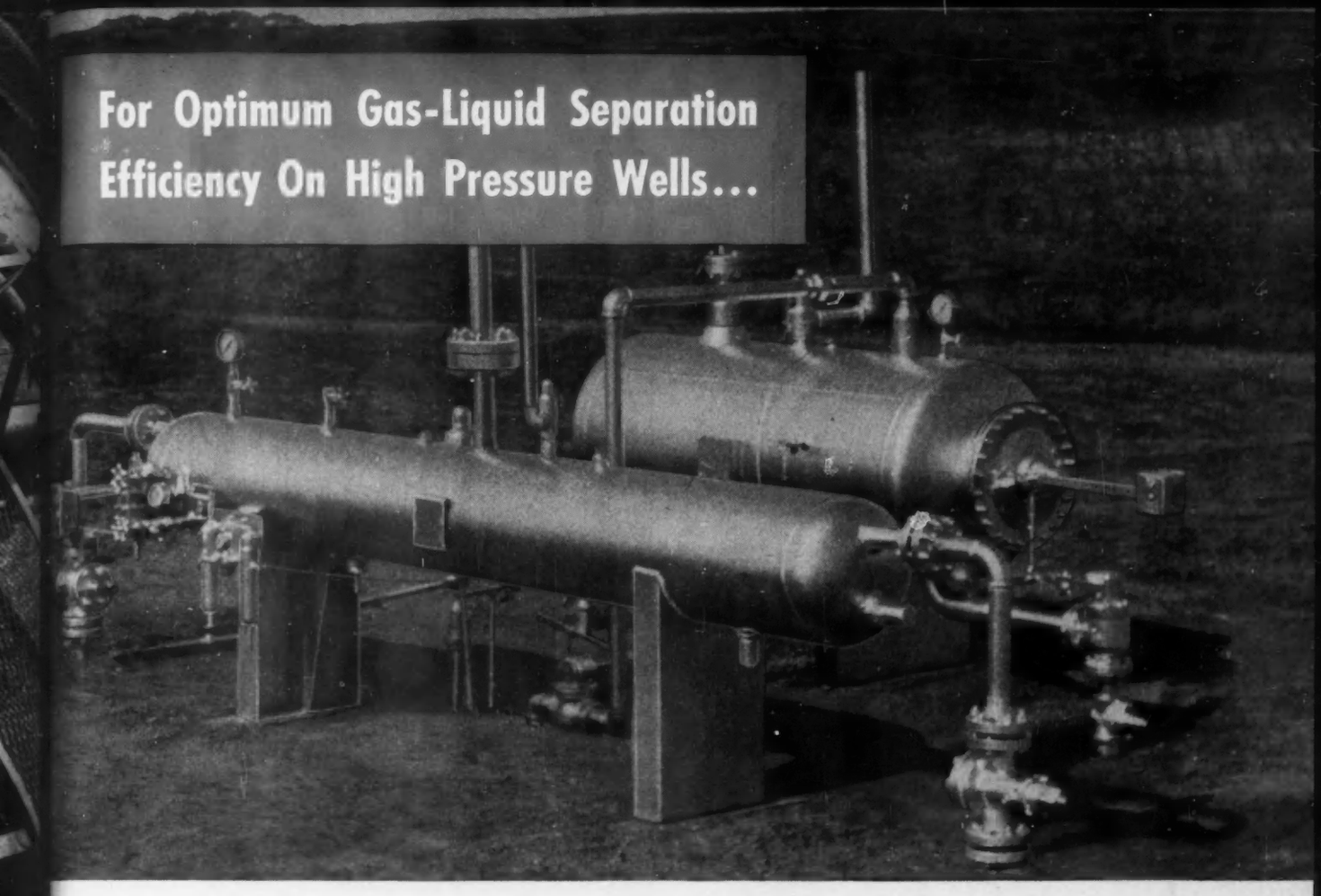
To learn more about LIGHTNIN mud control, write us for free Bulletin B-502.

Lightnin® Mixers™

MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 197-n Mt. Read Blvd., Rochester 11, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 10, Ont.



Specify

The BS&B Model DC Separator!

Because of its exclusive internal design incorporating a large gas-liquid separation chamber, a large liquid collecting and surge chamber, and a highly efficient mist extraction section all within its single horizontal cylinder, the Model DC Separator gives optimum separation efficiency on high pressure wellstreams.

Take the installation pictured above, for example. This Model DC Separator (foreground) is teamed up with a Model H Low Pressure Separator to form a two-stage hookup for processing the condensate-laden gas produced on a Kansas lease.

High gravity distillate is removed from the wellstream by the Model DC at approximately 60° F., and is then transferred to the Model H for further stabilization of the light ends at a reduced pressure of approximately 110 psi. Sales gas goes to the gathering line at 1000 psi, and condensate to the stock tanks at a pressure of 16 oz.

If you have a gas-liquid primary separation problem, why not get the facts on the Model DC from your BS&B Representative? Or you may write to . . .

MODEL DC SEPARATORS FEATURE...

- ✔ High Separation Efficiencies
- ✔ Proven BS&B Controls
- ✔ Easy Serviceability
- ✔ "In-Line" Hookup
- ✔ Excellent Cold Weather Operating Characteristics
- ✔ Wide Selection of Shell Sizes
- ✔ Working Pressures from 500 to 7500 psi.

EFFICIENCY · OVER 60 YEARS · BS&B · RELIABILITY

ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.

Oil & Gas Equipment Div., Dept. 1-B12
P. O. Box 1714 Oklahoma City, Oklahoma

Rod
Full Barrel
with Cup
Hold Down
¾" Bore
Stripper
Pump with
3-Cup
Bottom
Hold Down
Rod
Sectional
Liner
Pump—
Stationary
Barrel
with
Simplex
Top Lock
3 Tube
Pump
Regular
Type
Rod Liner
Pump—
Traveling
Barrel
with
Simplex
Bottom
Lock
Hold Down
Tubing
Sectional
Liner
Pump with
Reed
Standing
Valve
Puller
Plunger
Bottom
Valve
and API
Bottom
Lock—
Hold Down
and Shoe
Stationary
Barrel
with
Simplex
Bottom
Lock
Hold Down

JOIN THE PARADE

of thousands of enthusiastic users of

EMSCO D+B

SUBSURFACE PUMPS

for every type of subsurface pumping requirement

Tested in the oil fields of the world for half a century, D+B Pumps are made in a wide variety of sizes and types to meet every possible pumping condition. Constant research and advanced design, plus carefully controlled manufacturing, keep D+B Pumps out in front. You'll find enthusiastic users everywhere.

For D+B Subsurface Pumps and Parts to meet your needs or service on a 24-hour basis in all major producing areas, call your nearest CONTINENTAL or D+B Supply Store.

CONTINENTAL

Serving the Oil and Gas Industries

CONTINENTAL SUPPLY COMPANY
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General Offices: Dallas, Texas
Representatives in all principal oil fields of the world

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• DEEP WELL PUMPS
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QUALITY IS OUR PRODUCT
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EMSCO MANUFACTURING COMPANY
A Division of The Youngstown Sheet and Tube Company
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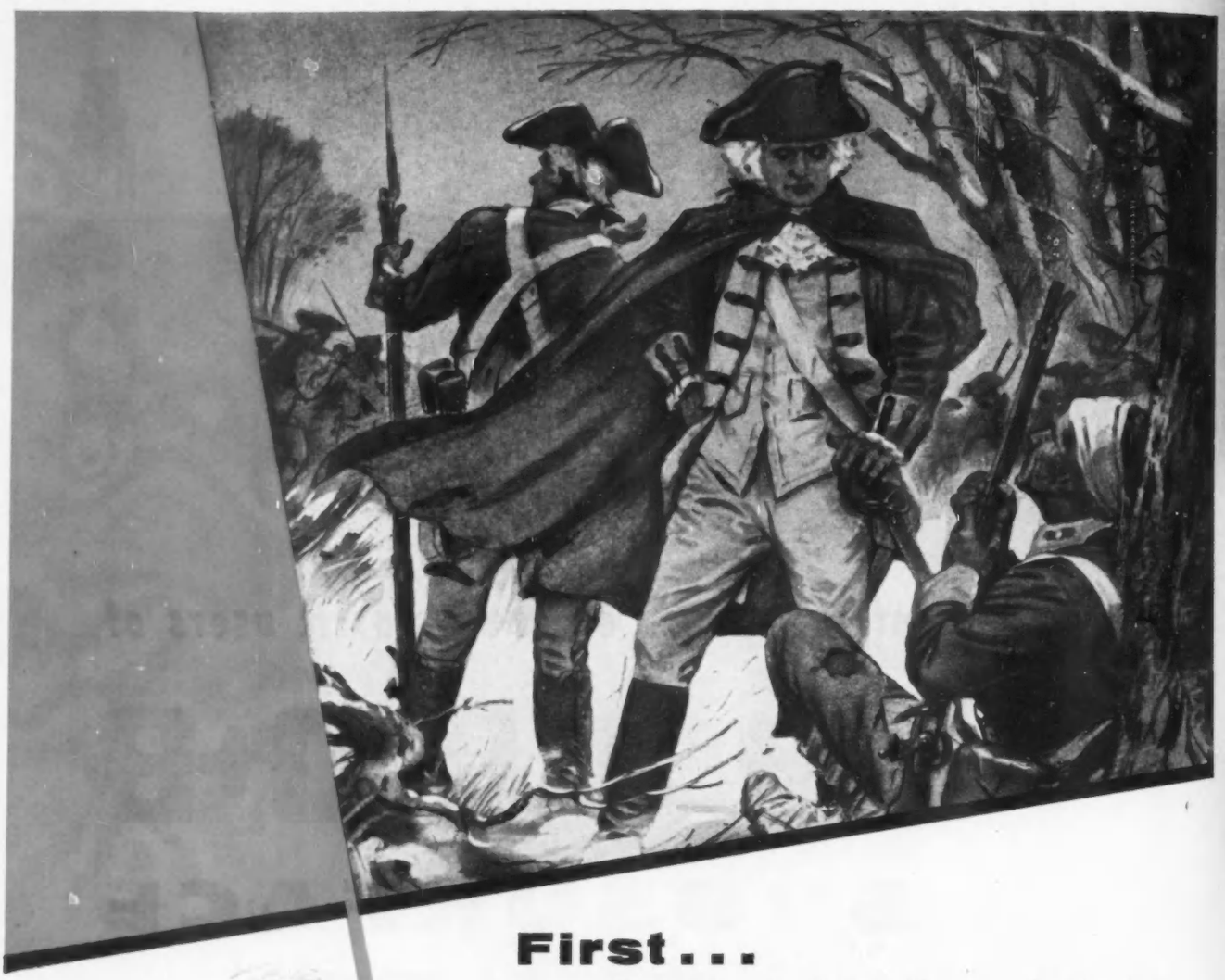

First . . .

George Washington, the first president, was first in war, first in peace and first in the hearts of his countrymen.

Year after year the Texas Employers' Insurance Association continues to be first with employers of labor in Texas, writing more Workmen's Compensation Insurance in Texas than its five principal competitors combined.

One reason for this popularity with Texas industry is the Association's low-cost plan of operation which has enabled it to save and return more than forty-nine million dollars to its policyholders in Texas.

Are you, like others in the Oil and Gas Industry, taking advantage of these SAVINGS?

Over
$49,000,000
Saved and Returned to
POLICYHOLDERS

TEXAS EMPLOYERS
INSURANCE ASSOCIATION

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SAN ANTONIO • SHERMAN • TYLER • WACO • WICHITA FALLS

A. F. ALLEN, *Chairman of the Board* BEN H. MITCHELL, *President*

Current Outlook Section

WORLD OIL

L. J. LOGAN, SECTION EDITOR

NEWEST, FASTEST FROM LANE-WELLS

KWIK-KONE

another new development from Lane-Wells, makes it possible to shoot your longest zones on one run. Straddle unwanted zones and shoot just the productive ones. KWIK-KONE does it because it can be custom-loaded and made up, in practically any length, right at your well. A fast, time-saving, tailor-made Koneshot perforator.

So, whatever your shooting zone — no matter how long — new KWIK-KONE can do it. Call your Lane-Wells man today — he has the full story.

LANE WELLS COMPANY

LANE-WELLS CANADIAN CO. IN CANADA
PETRO-TECH SERVICE CO. IN VENEZUELA

Write for complete KWIK-KONE information to > P. O. Box 1664, Houston 1, Texas

CREATIVE BANKING

stops the waste of flare gas

Creative banking builds wealth from waste. Nowhere is this better proved than in a South Texas field where gas was being flared because pressure was too low for gathering lines. No single owner in the field was big enough to put in the necessary packaged gas compressors to boost the pressure. So this project, as another example of creative banking, was initiated and financed by The National Bank of Commerce. As a result, gas that was wasted is now sold at a profit.

Through knowing the producers' specific problems, The National Bank of Commerce was able to provide a solution that made money for everyone. The Oil Loan Department knows that financing must be flexible enough to meet changing conditions as they arise. So many oil men have been helped to build soundly and constructively. Creative banking can help you, too.

The experience and resources of The National Bank of Commerce of Houston are now being used in Wyoming, Colorado, New Mexico, Texas, Louisiana, and Mississippi.

E. O. Buck, *Vice President, Oil Loan Department.*

THE NATIONAL BANK OF

COMMERCE

OF HOUSTON

Gulf Building — 712 Main Street

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

More new National Stores bring total to 129!

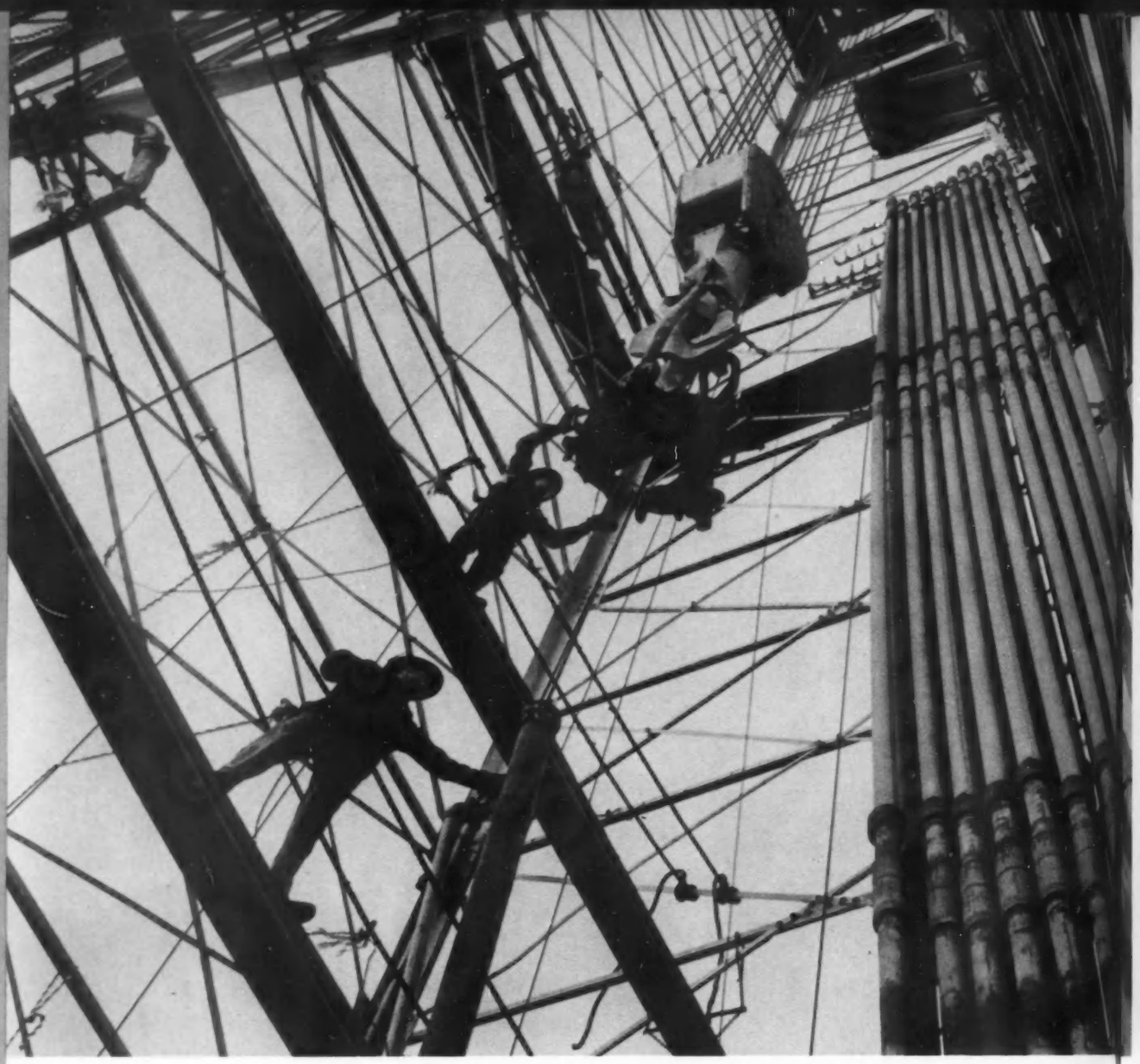
Opening day scenes like this have marked the recent and rapid growth of the National Supply Store system. During the first nine months of this year, we opened five new stores, bringing the total number to an all-time high of 129.

One of the new stores is in Citronelle, Alabama—our first in that state. Another, in Venice, Louisiana, meets the needs of many offshore operators. A new store in Cortez, Colorado, is supplying equipment in Utah's Paradox Basin. And two more in Aspermont and Borger, Texas—giving us a total of 32 stores in that state—serve several thousand square miles of active oil country.

Since National Supply began in 1894, we've opened more than 350 stores to serve oil fields in the U.S., Canada and Venezuela. We've also closed many to meet the shifting needs of the fast-moving oil industry. We will continue to open more than we close—and, in line with our policy, each will have complete stocks tailored for the area it serves.

If you haven't stopped in a National Supply Store for a while, you're missing a profitable shopping experience. In a modernized or new National Store, you can quickly see and select the quality equipment, parts and accessories you need. Colorful displays and racks of well-illustrated product literature aid you. And you get the reliable personal service that has helped to make us the world's largest manufacturer and distributor of oilfield machinery and equipment. Stop at the National Store nearest you.

THE
NATIONAL SUPPLY
COMPANY



Even under no loads, fast-falling National Blocks remain stable in operation.

There's a safety-engineered National Bl

You can count on safe, fast block action when you choose from National's complete line of Hook Blocks and Traveling Blocks. Every block is engineered for maximum safety, built for long service and thoroughly field-tested under rugged conditions. As outstanding results of National Supply's long experience in the manufacturing and testing of blocks, you get the quality features listed below:

SPECIAL HOOK FEATURES

- Hook body mounted on tapered roller bearings
- Elevator link supports equipped with positive retaining links
- Automatic-latching hook tongue cannot be accidentally opened
- Spring-actuated 8-position rotation lock
- Grooved hook body facilitates drill pipe alignment with elevator

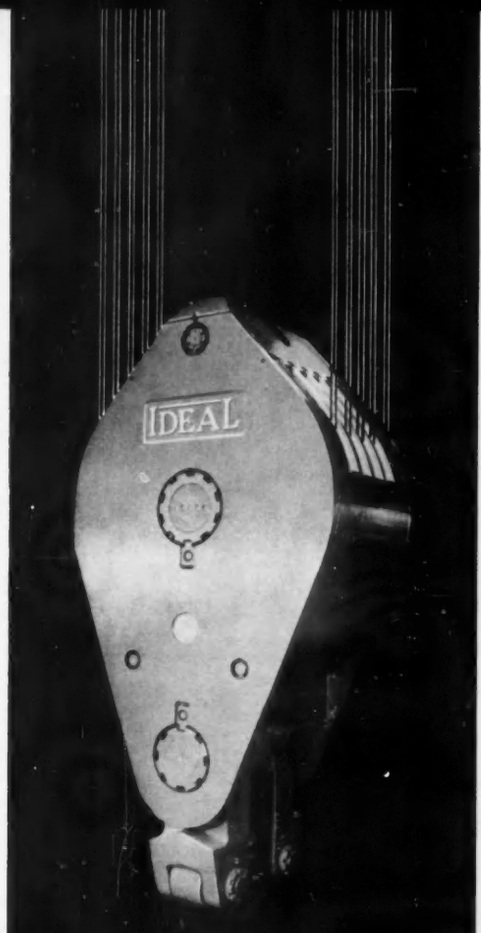
TRAVELING BLOCK FEATURES

- Sheaves independently mounted on tapered roller bearings
- Individual lubrication to each sheave bearing
- All parts securely locked for safety of men working below
- Streamlined—all nuts, bolts, pins and fittings recessed
- Short, low stressed pins and shafts

Your National representative can give you more information about National Hook Blocks, Traveling Blocks and companion Crown Blocks. Ask about the units best suited for your drilling program.

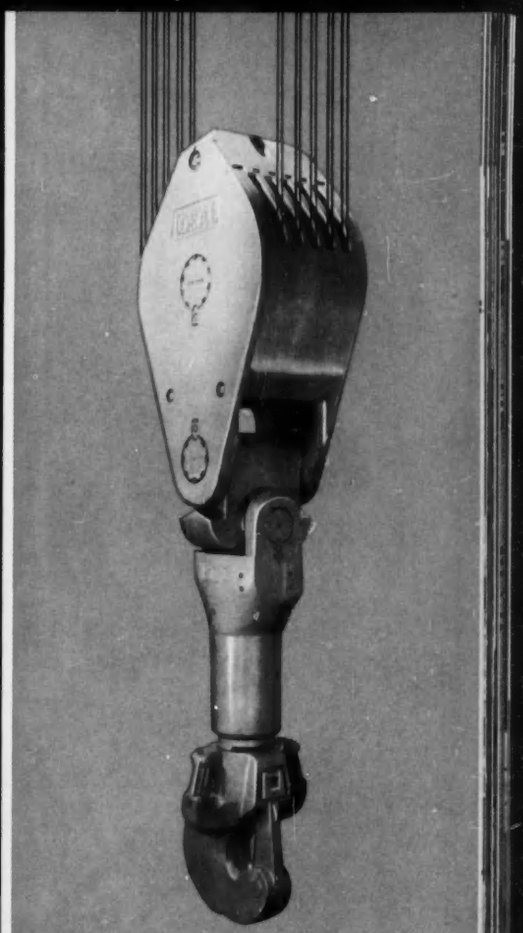
Type E
HOOK BLOCK

Designed for greatest possible saving in vertical derrick space, this 200-ton rated block is typical of the Type E line. Type E blocks are available in three sizes for 90- to 200-ton loads. A complete line of Type E traveling blocks is also available.



Type F
TRAVELING BLOCK

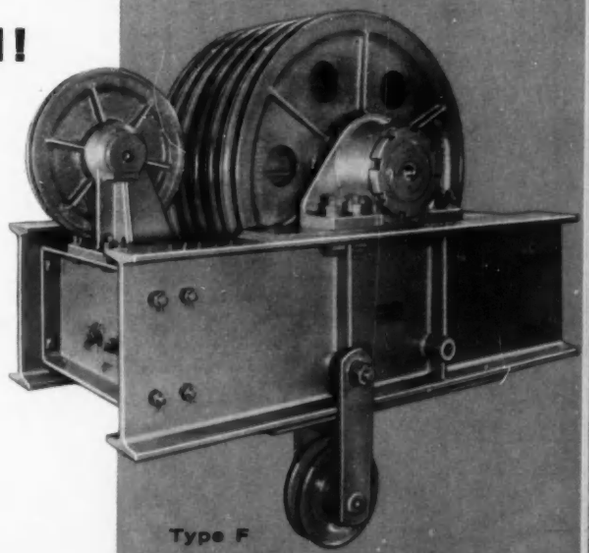
Typical of National's Type F series blocks, this 450-ton capacity traveling block is furnished with conventional lower clevis so that any separate hook or connector may be attached. Type F blocks are available in two sizes for 300- to 450-ton loads.



Type F
UNIVERSAL HOOK BLOCK

The swivel block "universal" pin joint feature in this heavy-duty, 450-ton rated block distinguishes it from rigidly connected hook and block combinations. Type F Universal Blocks are rated for 300- to 450-ton loads.

Block for every drilling need!



Type F
CROWN BLOCK

Rated at 525 tons, this is the largest of two Type F Crown Blocks available for deep drilling. The smaller unit is rated at 360 tons. Both blocks are of minimum width, have relatively short shafts and a correspondingly high strength to weight ratio. When necessary, they are easily dismantled in the field for installation.

THE
NATIONAL SUPPLY
COMPANY

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION OFFICES: Denver; Ft. Worth; Houston; Toledo; Tulsa; Torrance
CANADA: The National Supply Company, Ltd., 200 F. W. Clark Building, 709 Eighth Avenue, West, Calgary, Alberta
EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E. C. 1

NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

. . . .

and a streamlined National Swivel to help reduce your drilling costs!

Match a compact National Type N Swivel with your National Block and you have a smooth derrick equipment "team" that's tough to beat! Here are the reasons why National Type N Swivels give you continuous service at low operating and maintenance costs:

1. **Reduced weight.** Complete redesigning has been employed to bring every model down to minimum weight in relation to individual rated capacity. The use of high quality, high-strength components throughout has reduced both over-all height and weight to greatly facilitate handling.
2. **Lower center of gravity.** Centerline of the bail pins on Type N Swivels has been raised, thereby lowering center of gravity. This means greater stability in handling, makes connection of swivel "sub" to kelly easier and faster.
3. **Streamlined exterior.** The one-piece steel body is free from any dangerous projections. All bolts, nuts, pins and grease fittings are recessed to assure maximum safety to the derrick crew.
4. **Fast wash pipe replacement.** National's exclusive Uniflex Wash Pipe Box assembly is standard on all Type N Swivels. An improved method for packing off the mud, the Uniflex assembly has quick-acting threads to speed replacement, is easily assembled by one man, can be installed without removing the gooseneck or breaking the hose connection.
5. **Rapid hose coupling.** Also standard on all Type N Swivels is the Quick-Seal Hose Connection that speeds make-up of hose joints. Besides eliminating one hose connection member and therefore minimizing the chance of mud leakage, the Quick-Seal Connection features larger, quick-acting threads and sealing elements to withstand rugged use.

THERE'S A NATIONAL SWIVEL for every job, of course. The six in the Type N Line have comparative dead load ratings from 110 to 500 tons—and depth ranges extending from 2,000 feet to 24,000 feet. Find out soon which one you can best use to reduce your drilling costs. Just ask your National Supply representative for complete details.

THE
NATIONAL SUPPLY
COMPANY

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION OFFICES: Denver; Ft. Worth; Houston; Toledo; Tulsa; Torrance
CANADA: The National Supply Company, Ltd., 200 F. W. Clark Building, 709 Eighth Avenue, West, Calgary, Alberta
EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E. C. 1

NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

Exploration Section

When measuring the costs of a hole in the ground...

Price is not a wise cost comparison

"Blue Demon" Bit performance gives proven cost reduction

U.S. Patents
2,615,684 & 2,666,622 —
Others Pending

FIGURING bit cost on the price of the bit does not give a true cost comparison, since a number of variables are involved . . . rate of penetration, footage per bit, round trips required, bit service and finally bit cost per foot of hole drilled.

Hawthorne's "Blue Demon" Carbide Insert Rock Bit has become the leading all-formation drill bit in the exploration industry . . . used by more drillers than all other drag-type bits combined.

These field-proved replaceable blades, with superior inserts on the self-sharpening cutting edges, give faster, smoother penetration in hard formations . . . drilling from top to bottom without tripping between soft and hard formations.

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Drill more footage faster, smoother with long-lasting "Blue Demon" Bits, and cut your cost per foot of hole.

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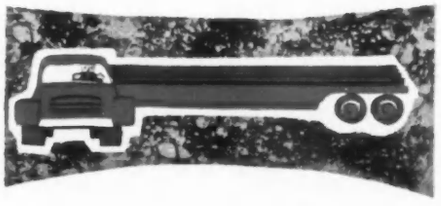

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Drilling Section

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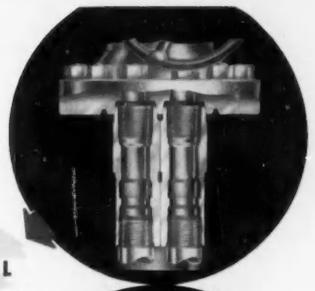
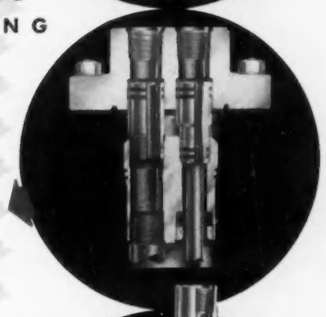
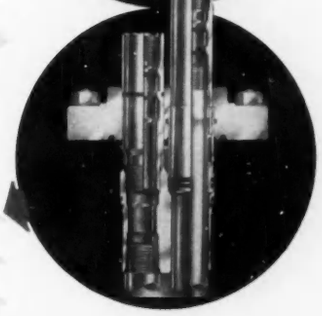
The O-C-T UNIVERSAL TUBING HEAD

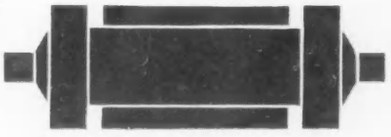
. . with 6 interchangeable dual string and single string tubing hangers!

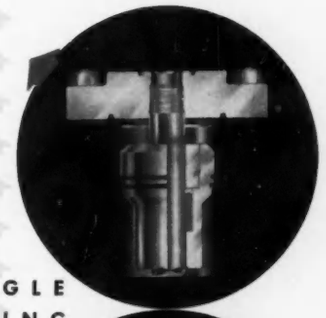


DUAL STRING

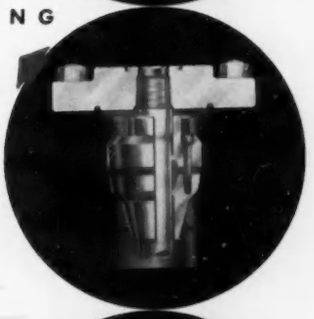


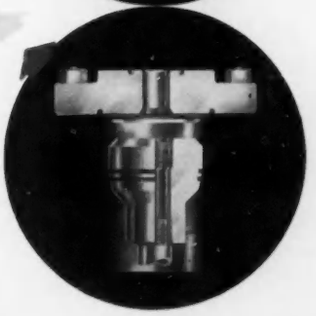


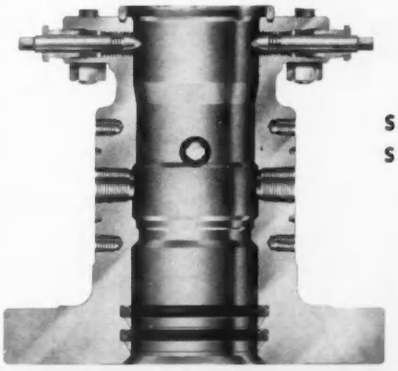




SINGLE STRING







The new O-C-T universal tubing head is available with a complete range of interchangeable tubing hangers for both dual and single strings. Last minute changes in completions can be made without changing tubing heads or using special attachments. If only one producing sand is found in a proposed dual well, the well may be completed by using a single string hanger. If a second sand is found in a well originally scheduled for single completion, the well may be completed with a dual hanger instead of the single hanger originally contemplated.

The O-C-T universal tubing head is equipped with two retractable aligning screws which are used to align the dual hanger with respect to the head itself. These aligning screws are retracted when single string hangers are used.

Safety is assured, since all hangers are run through, landed and locked in place prior to the removal of blowout preventers. Once the head has been installed, all seals can be field tested through test ports located in the flanges.

This universal head is available in 600 through 2900 series and flange sizes from 6" to 10". If an operator does not desire to remove the existing tubing head in order to dually complete a well, an adapter is available.

Any of six interchangeable hangers may be landed and locked in place through blowout preventers

All seals may be tested by a single application of pressure through a test port in the top adapter flange

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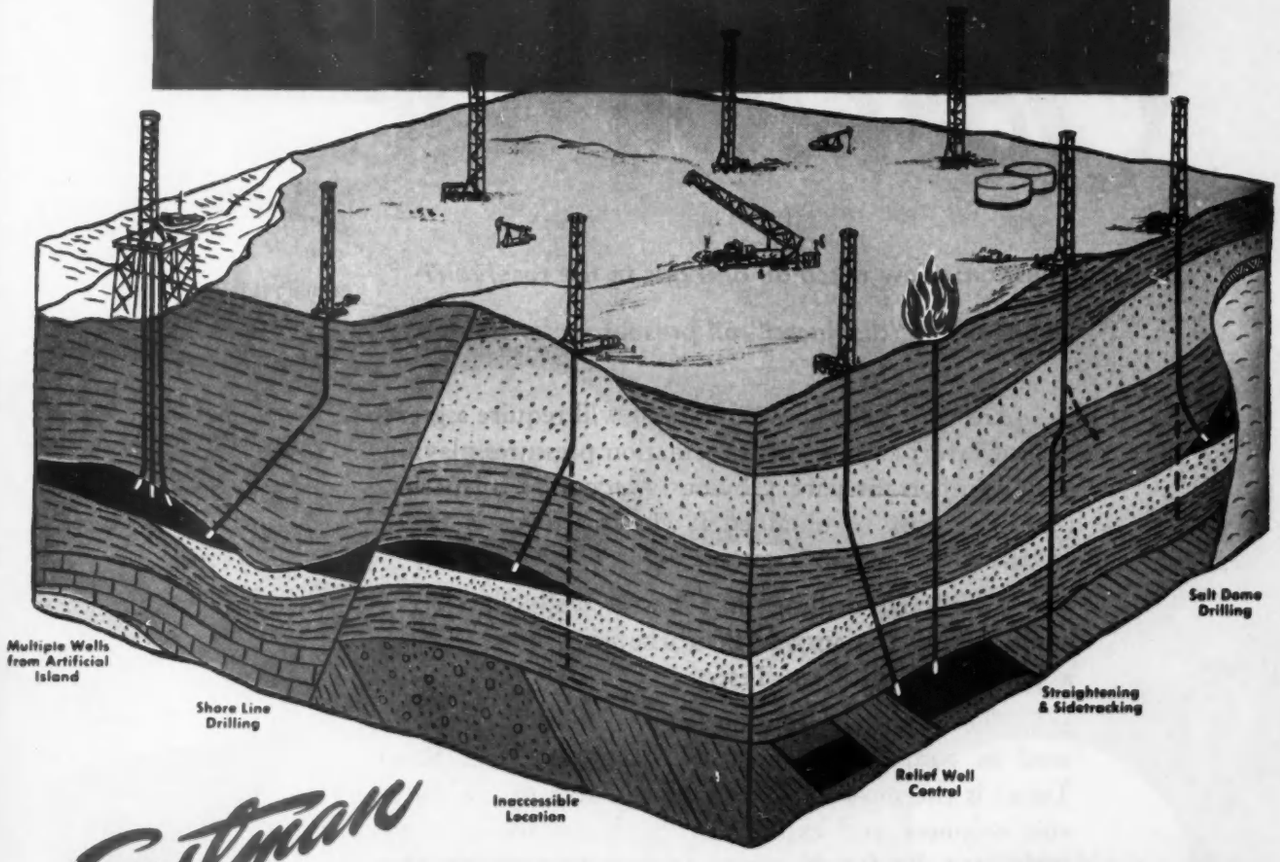

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Production Section

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Johnston test

Question: How much oil and gas in the reservoir?

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Answering the above questions will require a great deal of information—with formation pressures playing the all-important part. Obviously, *accurate* formation pressures must be obtained if either answer is to be anything more than a guess.

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The Johnston Tension Type Pressure Recorder used in conjunction with the Johnston Drill Stem Tester is the most valuable tool available to the reservoir engineer and exploration geologist for primary evaluation. By far the most accurate pressure recorder used in drill stem testing (5/100 of 1%), the Johnston Type "T" was designed for accuracy and dependability under the most severe conditions.

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Production Section

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Greetings and Best Wishes

THE Bovaird SUPPLY COMPANY

GENERAL OFFICES
TULSA, OKLAHOMA

85 YEARS OF PROGRESS WITH THE OIL INDUSTRY

NATURAL GAS PIPELINE COMPANY OF AMERICA'S QUINDUNO STATION—equipped with five Beaird-Ingersoll-Rand 12SVG 660 h.p. packaged compressors. Young radiators with lubricating oil coolers, gas interstage and after coolers and all necessary controls. Other sizes 110 to 660 h.p.

Packaged Compressors Handle —

CRITICAL SOUR GAS PRODUCTION PROBLEM

3300 packaged compressor horsepower is used in the Natural Gas Pipeline Company of America's Quinduno Field station to boost sour casinghead gas through a desulphurization plant and into transmission lines. Providing this horsepower are five Beaird-Ingersoll-Rand 12SVG 660-h.p. units. Gas engineered for the job, the units are equipped with stainless steel compressor piston rods and special rings. Engine radiators which contain gas interstage and aftercooling sections, have been constructed with admiralty metal tubes and aluminum fins. All compressor fittings and scrubber elements have been built from non-corrosive materials.

Capable of handling up to 25 mmcfd, the units pick up at 19 psig and use two stages to boost the gas to transmission line pressure of 260 psig.

Packaged compressors were selected by Natural Gas Pipeline because of the savings that could be achieved in installation time and labor. Also should the gas volume drop off, one or more plants could be moved as complete units to other service. The remaining units would then economically continue production throughout the life of the field. Each of the units when finally taken out of this service, and moved to another, will be almost wholly salvaged.

Let us show you how a Beaird-Ingersoll-Rand packaged compressor plant can be designed to meet your special operating requirements.

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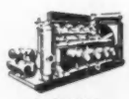
THE J. B. BEAIRD COMPANY, INC.


PACKAGED COMPRESSOR PLANTS

CAST STEEL FITTINGS

PRESSURE BULK STORAGE

ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS

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COMPLETE STRESS RELIEVING ON BEAIRD PRESSURE STORAGE TANKS

Engineers will tell you that stress relieving produces safer, more dependable storage vessels by eliminating internal stresses set up during forming, rolling and welding of tank sections. This important safety feature is available from Beaird, Shreveport, where one of the South's largest stress relieving furnaces is in operation.

Capable of handling tanks up to 75,000-gallon capacity, the stress relieving furnace has been installed as part of the tank assembly line. This permits volume production of stress relieved tanks without change or delay in shipping schedules.

When you buy Pressure Storage from Beaird you get the Beaird *PLUS*—

"Controlled Quality Construction":

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Submerged arc machine welding
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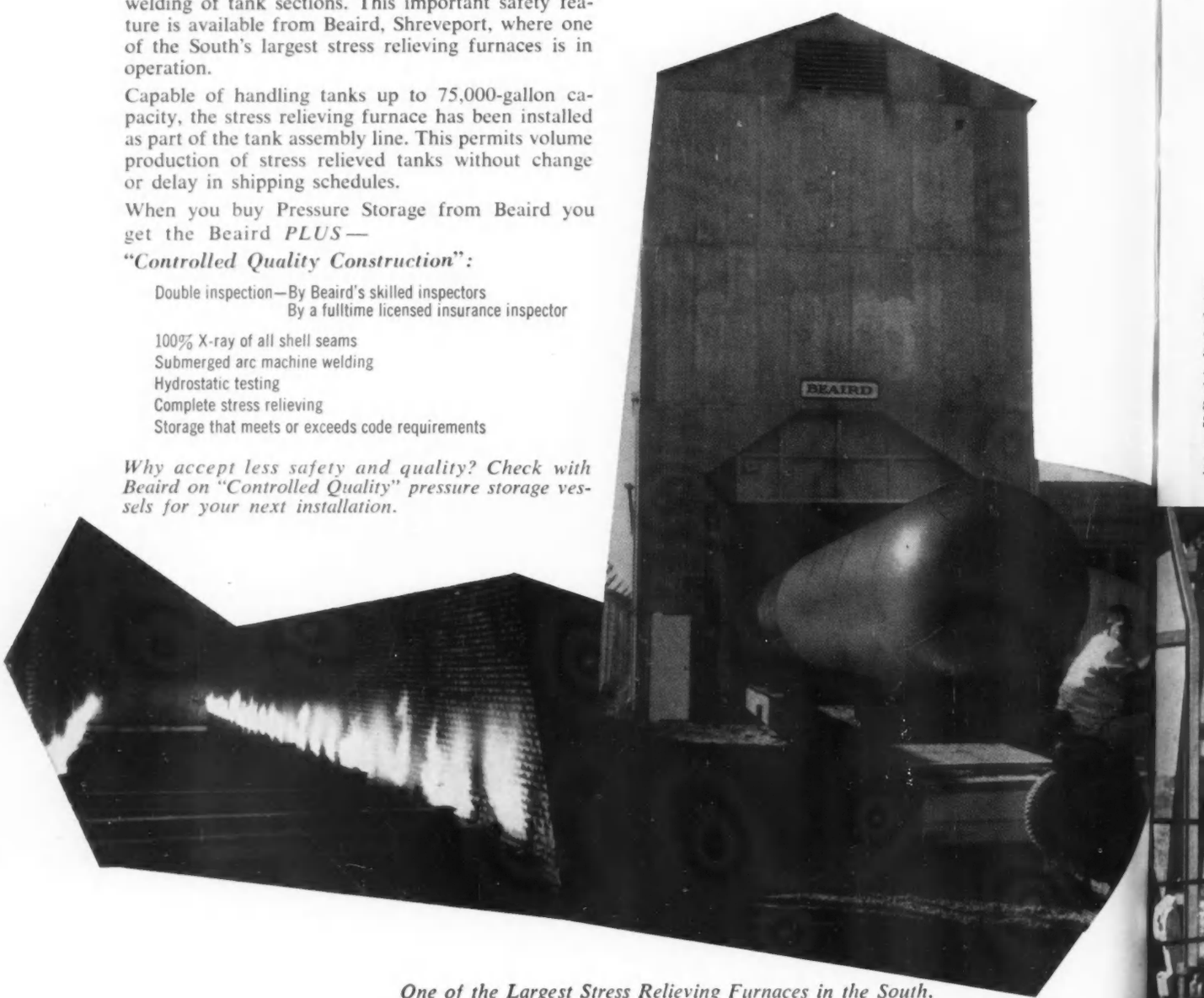
Complete stress relieving
Storage that meets or exceeds code requirements

Why accept less safety and quality? Check with Beaird on "Controlled Quality" pressure storage vessels for your next installation.



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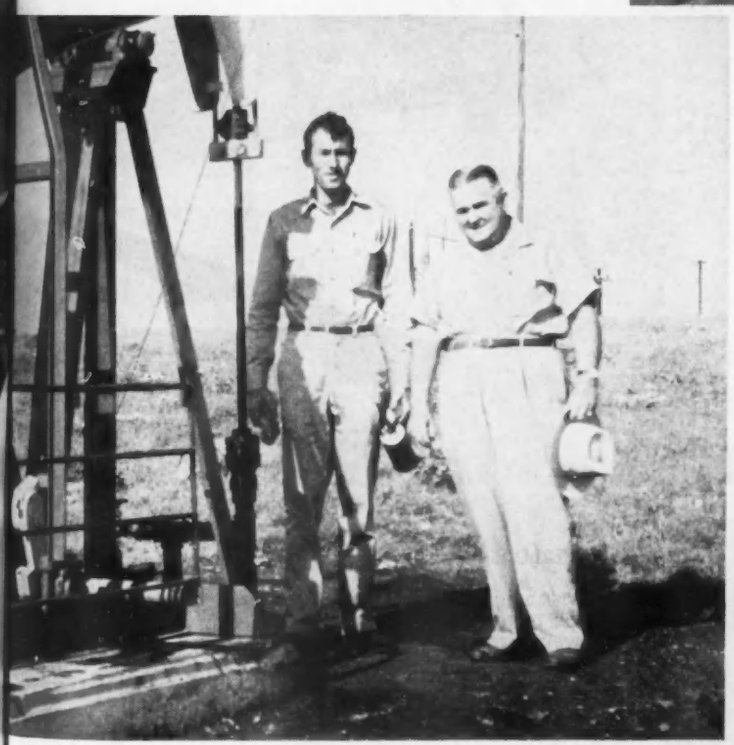
AXELSON PICTORIAL

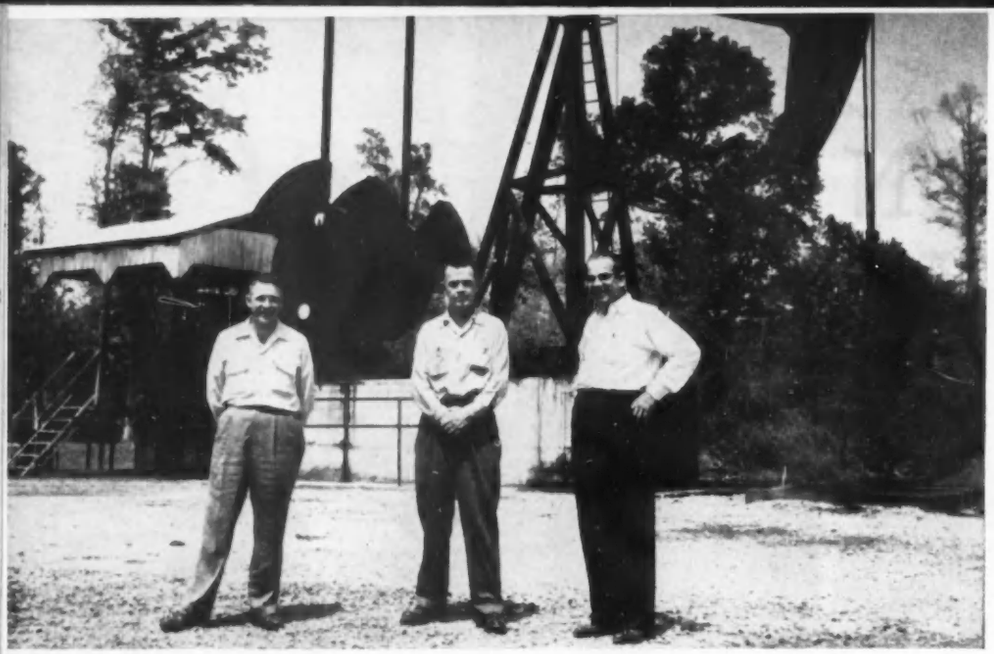
SWAMPED. Curly Robin, Pumper for the California Company in the Plumb Bob Field, Lafayette district, Louisiana, gives the stuffing box a shot of grease on the St. Martin Land Company #1. An Axelson RL Plunger Pump (2½ x 1¾ x 15) pumps 156 B/D of 37 gravity oil from 5,100 ft. Curly visits his swampland wells by boat.

COSTS CUT. Don Williams (left), Pumper for Seneca Oil Company, and Jack Felton, Axelson Representative, beside the No. 23 Linn in the T.C.U. Field, Cook County, Texas. This well was pulled on an average of twice a month until an Axelson 1¼" Acme Pump with Duax Liners was installed September 1955. It has been running continuously ever since, 24 hours a day, and has not been touched. Seven other wells were converted to Axelson Acme Pumps and *pulling costs were cut from $475 to $75 per month.*



HEARTBEAT. Checking the pulse is Frank Roberts, Pumper for National Associated Petroleum Company, on one of the company's 60 pumping wells in the Whitetail Field, Osage County, Oklahoma. All of these wells are equipped with Axelson 1½" Sure Seal Pumps and Axelson ⅝" Rods, and pump from the Mississippi Lime at 2050 ft.

AXELSON
USI



AXELSON

USI

THE DEEPEST. An Axelson 1¼" bore pump with hardened cast iron liners and 60" heavy chrome-plated stainless steel plunger, pumps 20 BPD of 38 gravity oil from 10,178 ft. This is the deepest pumping well in the Mallalieu Field, Brookhaven, Mississippi. A 3-step Axelson #59 sucker rod string actuates the pump. (l. to r.) Harold Long, J & L Store Manager, Brookhaven; Pat Moran, Production Foreman, The California Company (and Yogi Berra fan); Truman Reader, Axelson Representative.

GOOD RECORD. In front of Ashland Oil & Refining Company's #1 Crouch at Luther, Oklahoma, is Tom Charter, Pumper, and Charles Chandler, Chief Gauger. This well was completely Axelson equipped on July 1, 1955, with a Hydrax pumping unit, Axelson sucker rods and Axelson deepwell pump. It lifts sweet oil (39 gravity) from the Red Fork Sand at 5,062'. *To date no repairs have been necessary on any of the equipment.*

ON REQUEST. Axelson has a limited supply of "Factorules", a slide rule for calculating production, loads and other factors in pumping wells. It provides a quick means for estimating production and efficiency of wells produced by sub-surface reciprocating pumps and sucker rods. A Factorule complete with instructions will be mailed free of charge when requested on your company letterhead. Write to Dept. W.

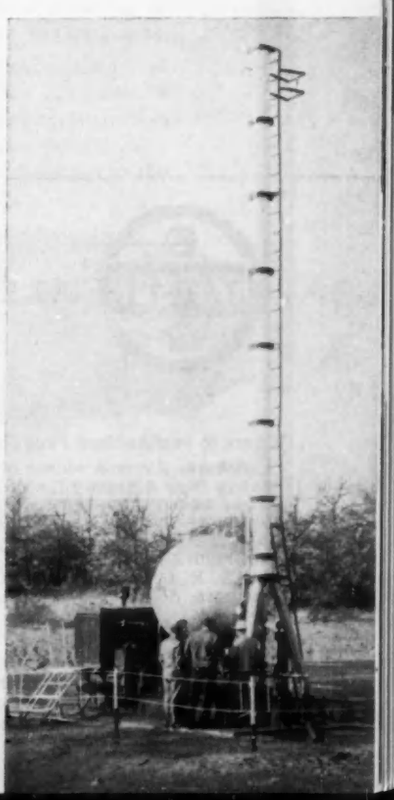
NEW FIELD. B. L. Coggins, Production Foreman for McNeish & Grallap, looks after 28 producers on the Muller Lease in the Cleveland Sand Field, Kay County, Oklahoma. This is a relatively new field, first discovery was 1954. The 14 wells on the pump *(all equipped with Axelson rods and pumps)* produce from the Cleveland Sand at 3,150'. Pressure drop is rapid and it is expected the 14 flowing wells will soon go on pump, too. "When they do, they'll be outfitted with Axelson equipment. You can be sure of that!" B. L. states.

AXELSON PICTORIAL

OKLAHOMA'S FIRST. This is the Nellie Johnstone #1 located in the city park at Bartlesville, Oklahoma. Completed April 15, 1897, it was the *first commercial oil well* in Oklahoma. It produced until about 2 years ago from 1900 ft. and is now plugged. Reading the inscription is M. J. Bohnsack, Salesman at the Jones & Laughlin Store at Bartlesville. This was the *first supply store west of the Mississippi*. J. & L. is distributor for Axelson pumps and sucker rods in all oil producing areas east of California.

TWINS. Ray Postier, Production Pumper of P. G. Lake, Inc., set up this dual job on the Cogswell Heirs Well #2, Garfield County, Oklahoma. Axelson Pumps and Rods are pumping both pays; a 1½" Axelson insert pump produces the Marshall sand at 6150' while an Axelson 1¼" Axelson pump produces the Meisner sand at 5950'. An Axelson two-step rod string composed of 45% ¾" rods and 55% ⅝" rods is used with both pumps.

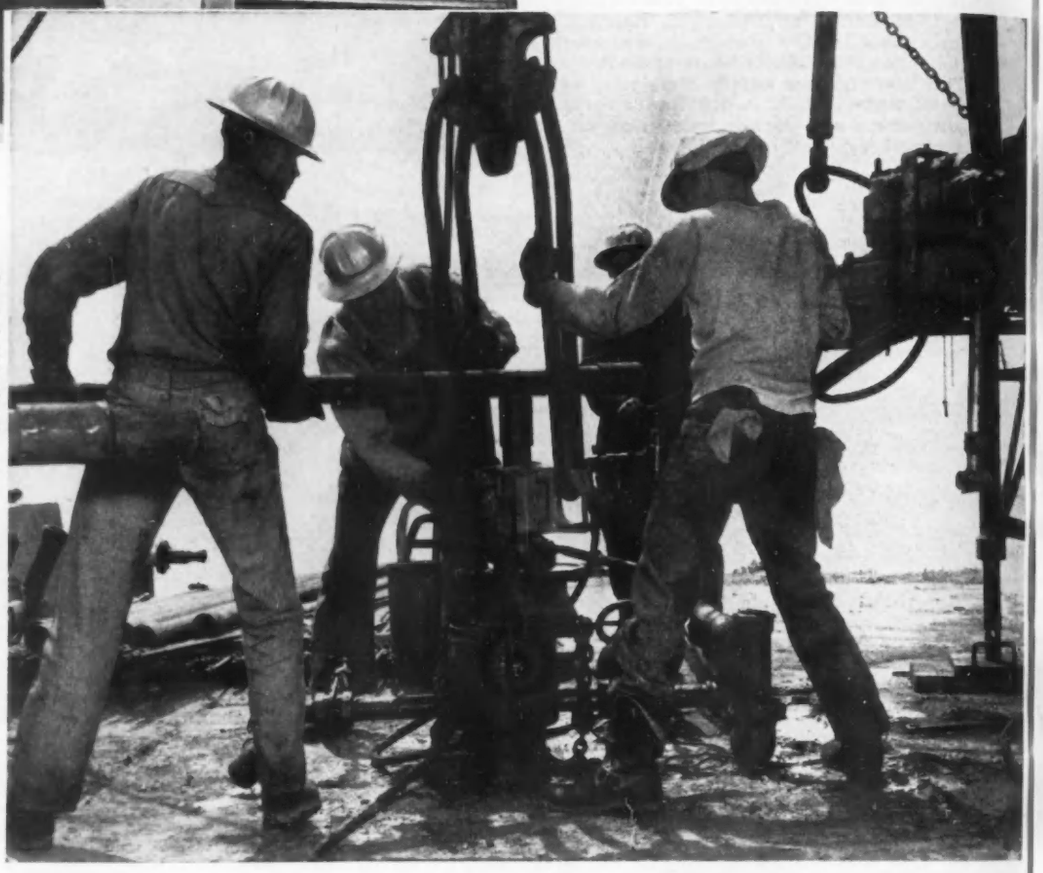
HARD WORKER. Operating at 6 strokes per minute, this Axelson Long Stroke Hydraulic Pumping Unit pumps from a 9,300 ft. depth in the Sarrah Burks Lease near Lindsay, Oklahoma for Magnolia Petroleum Company. These units are recommended where large volumes must be raised from great depths. The slow pumping rates increase the life of sucker rods and sub-surface pumps as high as 8 times their normal life expectancy. A 2½ x 1¼ x 40 Axelson Rod Liner Pump is at bottom. W. T. Holman is the Pumper.



SMALL WONDER. This is one of 18 Axelson Hydrax pumping units specially designed for Union Oil Company to pump the low gravity crude (8.5 to 13) in the Guadalupe Field, California. A diluent is pumped down Axelson Hol-O-Rods and an Axelson TLE pump with Duax Liners lifts 65 B/D with 50% sand cut from 3,100 ft. (l to r) Bob Talley, District Foreman; Cliff Dunham, Assistant Production Foreman; Bob Smith, Production Foreman (all of Union Oil Company). Chuck Garner and Bob Quinn (Axelson).

AXELSON PICTORIAL

PUBLIC DEMONSTRATION. Harold F. Allen, Science Instructor at Coalinga College, California, uses a model of an Axelson RLA (rod-type) subsurface pump to explain the principle of artificial lift to his engineering students. Axelson gladly makes available these model oilwell pumps to schools and colleges for classroom study. A 15-minute demonstration will often save hours of classroom discussion and blackboard diagramming.



TUBING RUN. High on a hill overlooking the blue Pacific at Capitan, California, General Petroleum Corp's well service crew runs tubing back into the well while Hydro-Test runs a simultaneous check for tubing leaks. Equipped with an Axelson 2" RLB Pump and Axelson ¾" #59 Sucker Rods, this well makes 12 B/D of 28 gravity crude from 2,600 ft. (l. to r.) Edwin Bruce, June Garland, Burl Hankey (Gang Pusher), Cecil Sutton.

No. C

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AXELSON MANUFACTURING COMPANY

Division of U. S. Industries, Inc.

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for better production

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Where to buy Axelson Hydraulic Pumping Units:

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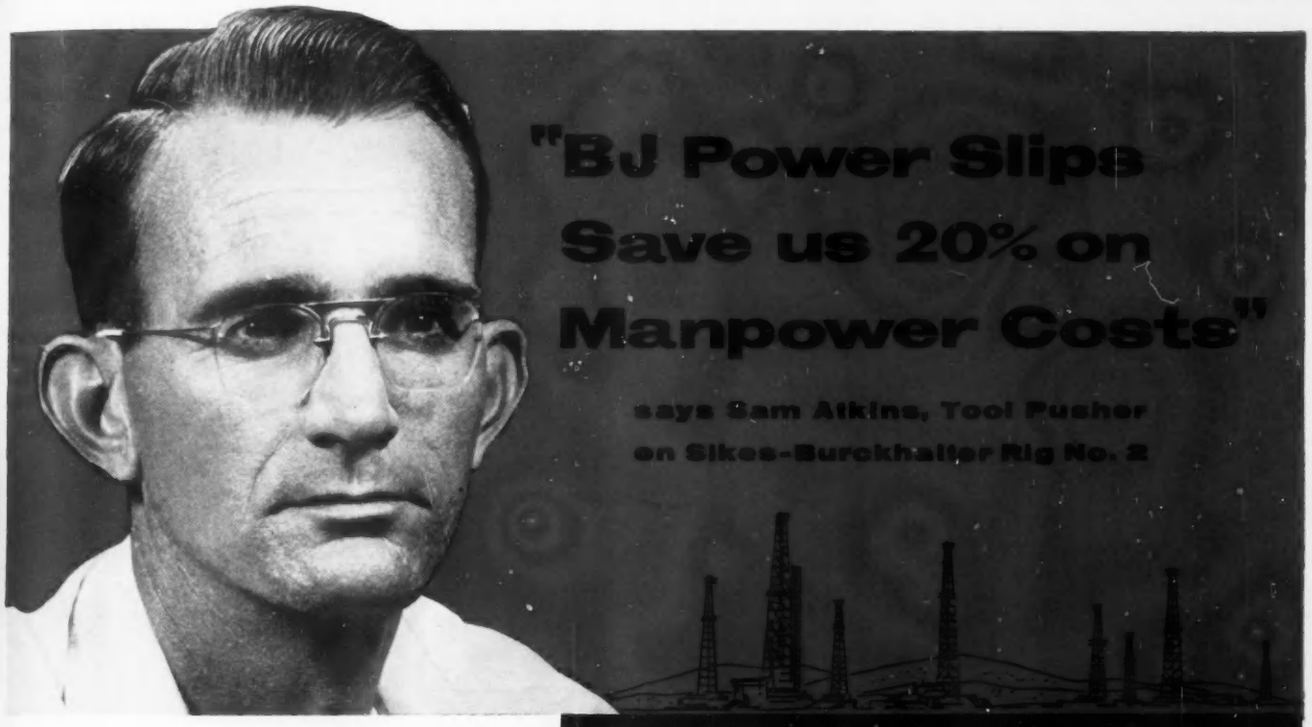
International Section



"BJ Power Slips are the prime reason for our using only 4-man crews, even on deep holes.

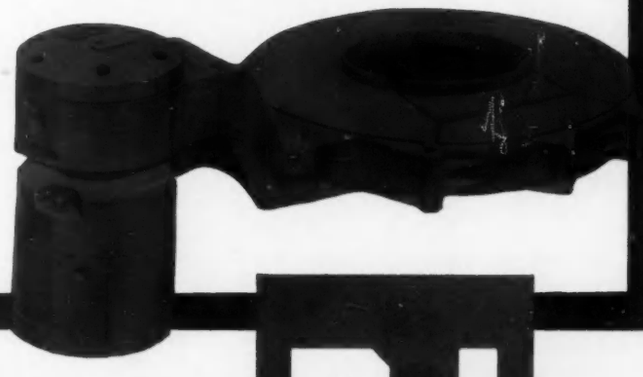
"Our crews like BJ Power Slips because they eliminate the setting and pulling of hand slips on round trips . . . which any roughneck can tell you is hard work. With the BJ Power Slip the men stay fresher, and get us back on the bottom faster, ready to make hole.

"Safety is also a big point. We don't have to worry about the whirling handles of hand slips. And crews are clear of the moving pipe and elevator because slip operations are controlled by the driller.

"As a tool pusher I like the fact that these slips don't have to be stripped on and can be swung out of the working area when not in use. Also they have a full opening to pass drill bits, reamers, drill collar stabilizers and centralizers."

Big Benefits of BJ Power Slip

- The only power slip that can be unitized with a rotary table . . . *installed and moved as a unit!*
- Side opening allows the BJ Power Slip to be quickly closed around or removed from the pipe.
- Pressure raised and pressure set by foot pedal control by driller – *automatically* pressure centers the pipe in the table.
- Moves out of the way during drilling. The BJ Power Slip swings away from the rotary table and can be positioned out of the working area.
- Automatic safety features. A built-in pressure relief valve automatically relieves air pressure in power cylinder if elevator accidentally strikes arm ring of Slip. A pilot-operated safety valve automatically holds Slip in "up" position in the event of an air line failure.



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A Subsidiary of Borg-Warner Corporation

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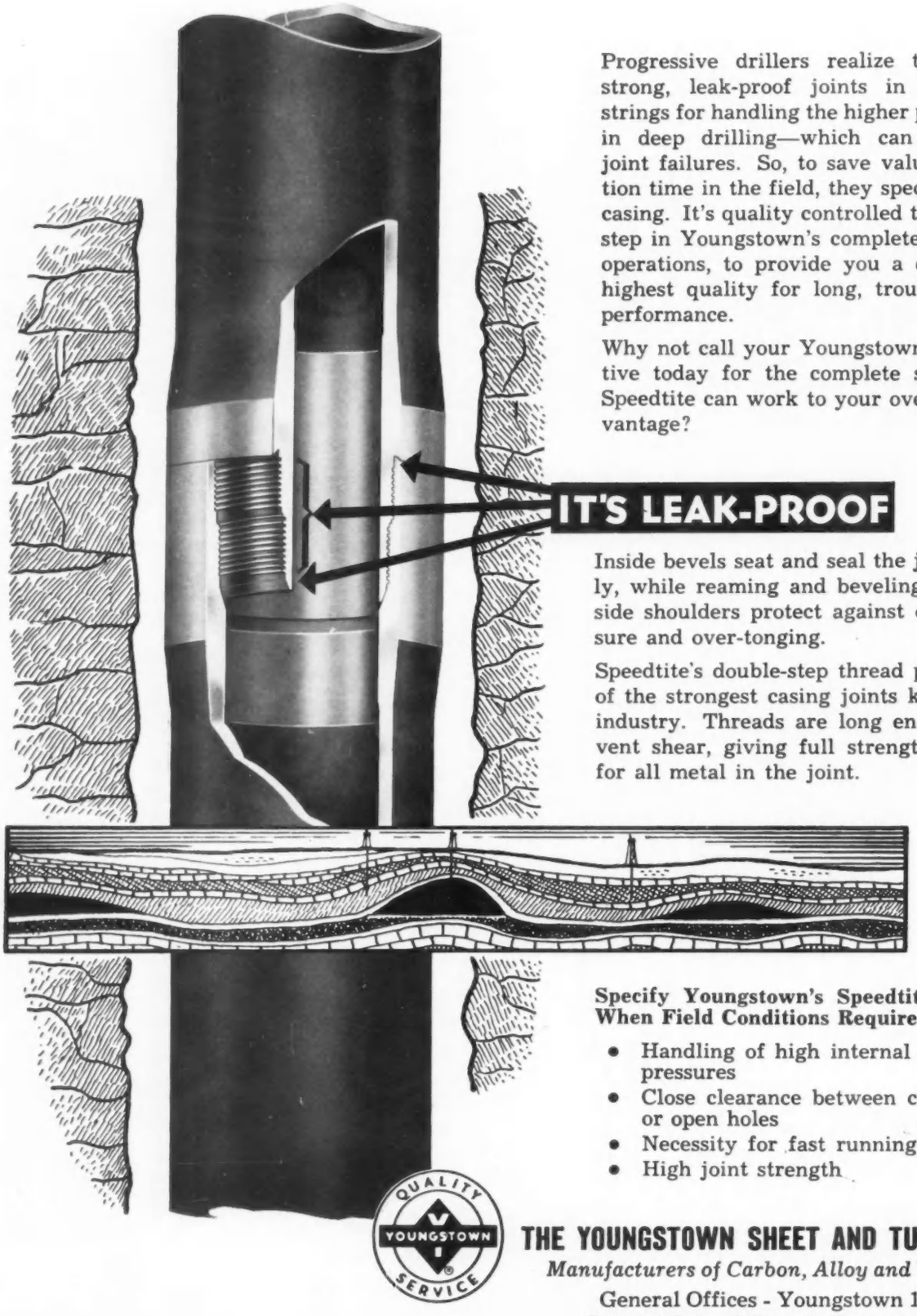
Export Address: 580 Fifth Avenue, Suite 510, New York 36, New York

Offices in Houston, Fort Worth, Denver and New York. Sales Engineers in all Principal Oil Fields.

BJ

LEAK-PROOF SPEEDTITE® CASING GUARDS AGAINST COSTLY JOINT FAILURES



Progressive drillers realize the value of strong, leak-proof joints in their casing strings for handling the higher pressures met in deep drilling—which can often cause joint failures. So, to save valuable production time in the field, they specify Speedtite casing. It's quality controlled through every step in Youngstown's completely integrated operations, to provide you a casing of the highest quality for long, trouble-free field performance.

Why not call your Youngstown Representative today for the complete story of how Speedtite can work to your over-all cost advantage?

IT'S LEAK-PROOF

Inside bevels seat and seal the joint perfectly, while reaming and beveling of the outside shoulders protect against outside pressure and over-tonging.

Speedtite's double-step thread produces one of the strongest casing joints known to the industry. Threads are long enough to prevent shear, giving full strength in tension for all metal in the joint.

Specify Youngstown's Speedtite Casing When Field Conditions Require—

- Handling of high internal fluid pressures
- Close clearance between casing strings or open holes
- Necessity for fast running speeds
- High joint strength

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Manufacturers of Carbon, Alloy and Yoloy Steel

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Dowell engineers at remote controls of three Allison powered pumpers during high-injection-rate fracturing treatment.

Aircraft power for faster injection

High-injection-rate fracturing provides better distribution of sand and treating fluid throughout the pay section. This means increased drainage area and a slower production decline. To give you the injection rates you need, with less equipment, Dowell now offers a new pumping unit powered by the famous 1500-h.p. Allison aircraft engine. Pound for pound, this unit delivers more horsepower than any other pumper in the oil fields.

Ask Dowell about using its great new frac team: (1) the Allison engine pumper for the power you need; (2) the exclusive Remote Control Unit which provides unmatched safety for men and equipment; (3) the new Dowell blender for controlled mixing of up to 35 barrels of oil and sand per minute.

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A Service Subsidiary of The Dow Chemical Company
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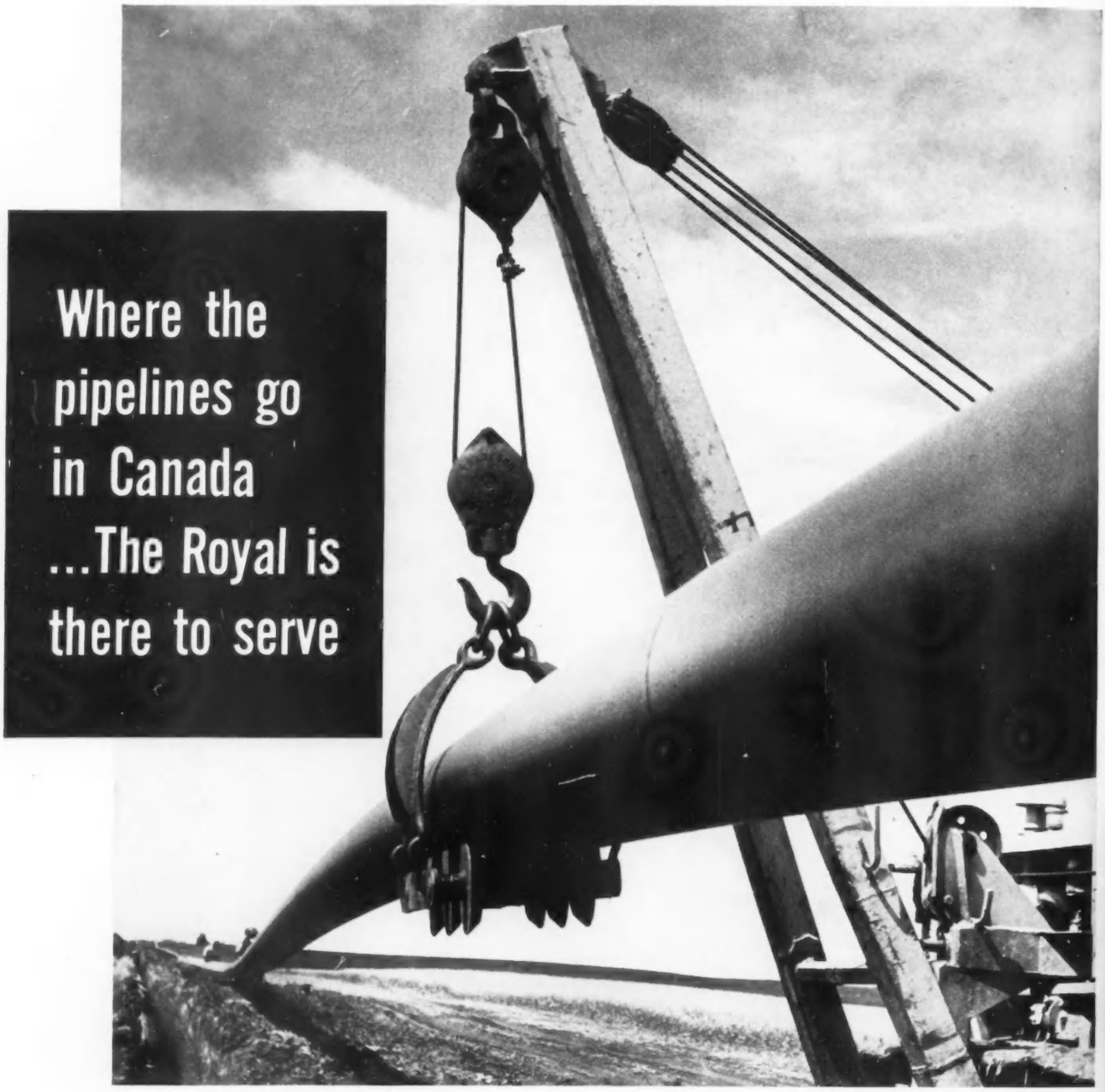


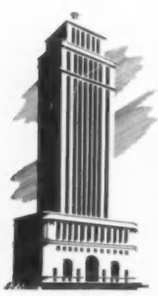
Where the pipelines go in Canada ...The Royal is there to serve

Canada's largest bank has grown with Canada's oil industry from the earliest days of gas and oil development.

A branch of this bank opened in Turner Valley back in the late 20's. The important Leduc discoveries occurred in 1947; the "Royal" branch at Leduc opened the same year. Devon and Redwater branches followed in 1949. The Royal Bank was the first to open a branch in Alberta's new Pembina field back in the early months of 1954. All told, there are more than 290 branches of this bank strategically placed throughout Canada's oil and gas rich western provinces.

Canada's largest bank has well earned its familiar unofficial name—"Canada's Oil Bank". Whatever phase of the industry you're engaged in, you'll find many advantages in making it *your* bank, too.

We do not provide information on oil securities.



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The Royal Bank issues bulletins from time to time covering statistics, regulations, tariffs, oil and gas financing, and kindred subjects. These are free on request. For a list of current bulletins write to The Royal Bank of Canada, Oil and Gas Department, 409 – 8th Avenue West, Calgary, Alta.

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These men are available from one of 33 sales offices and can draw on the facilities of four manufacturing plants.

Get the right equipment for the job at the right time—and if needed the knowledge of a Christensen Sales Engineer—it'll mean "Less Cost Per Foot."

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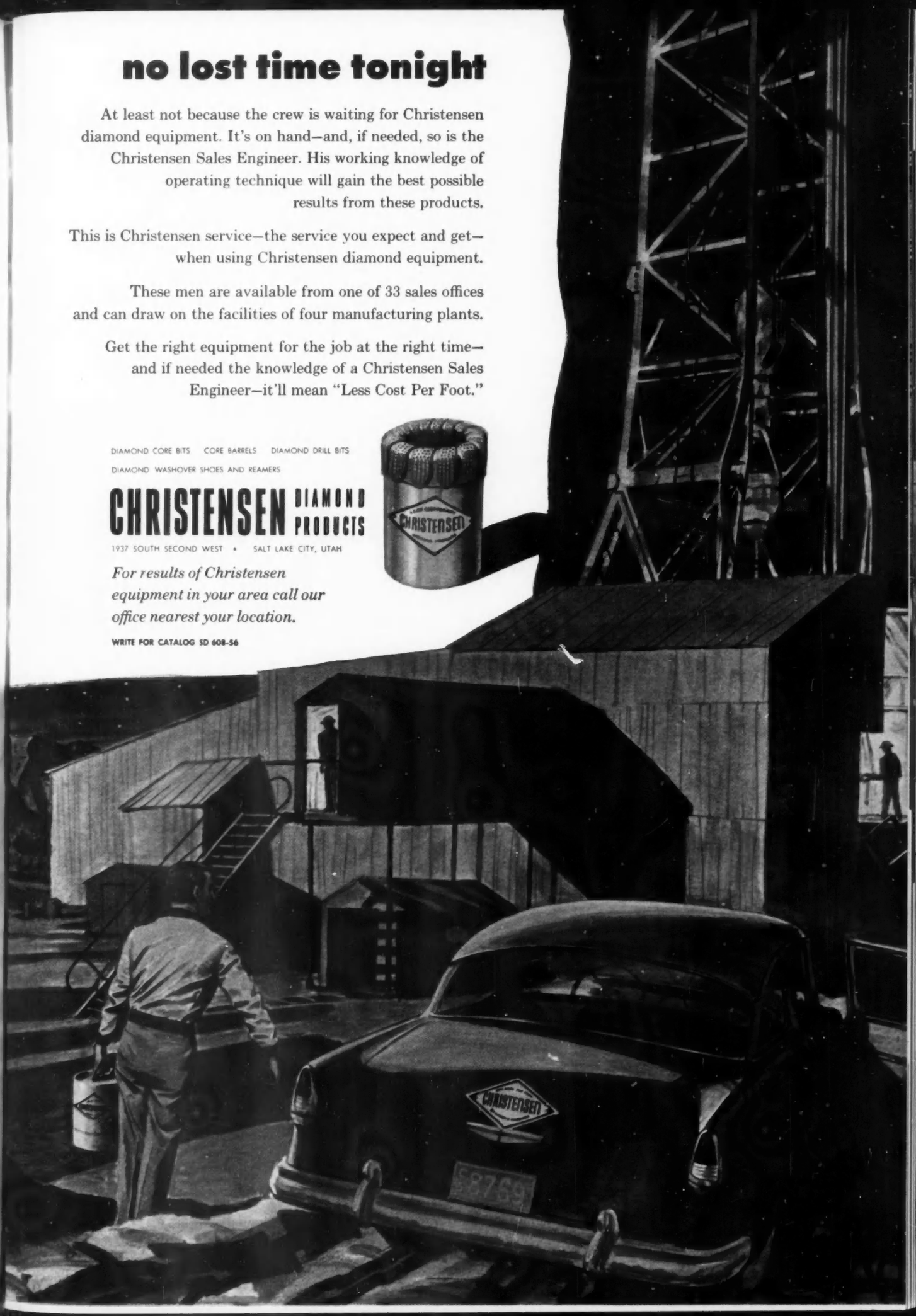
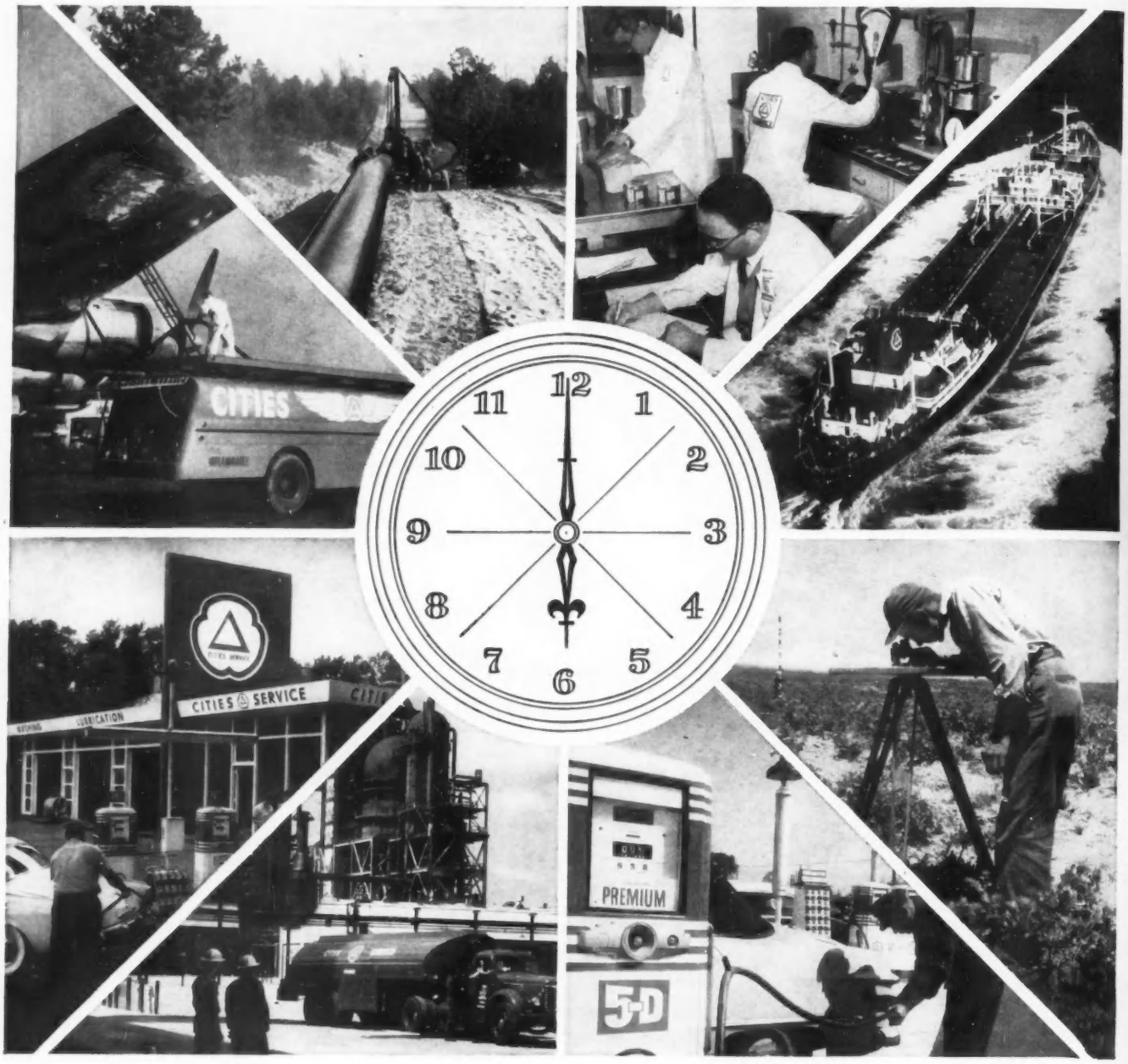




A DAY

in the lives of a quarter of a million people

More than 240,000 people keep Cities Service, one of the world's largest oil companies, operating at full steam . . . 240,000 people who locate, produce, refine, improve, market and invest in the petroleum that constitutes any oil company's lifeblood.

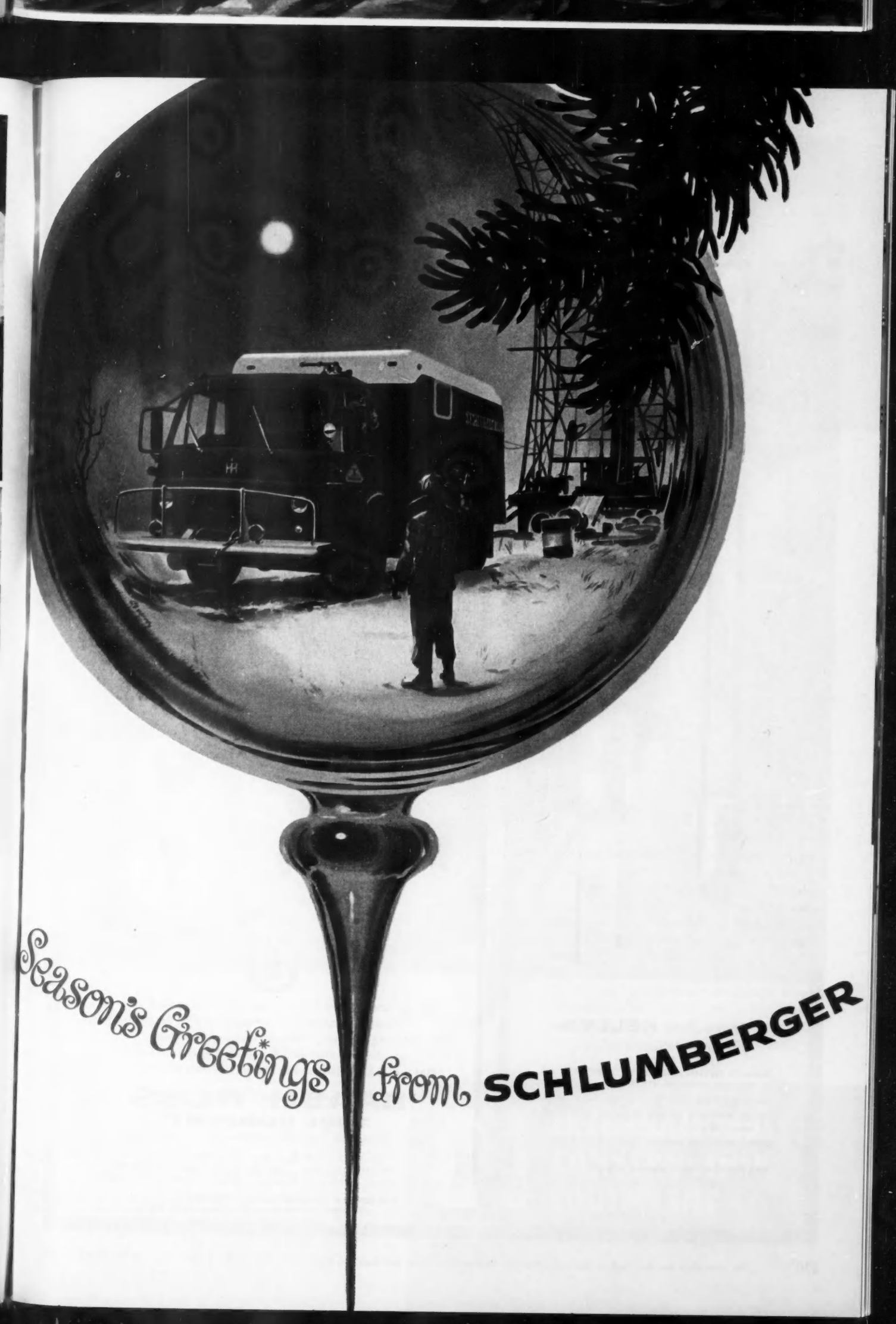
A winning team? Judge for yourself: Today, Cities Service is pushing forward in ever longer strides, with new refining facilities and techniques, new oil discoveries, new pipelines and tankers, new dealers, and new and improved petroleum products, unsurpassed in quality.

Moreover, the very fact that this surging activity exists, serves to assure further expansion . . . for healthy growth stimulates still more growth.

And significantly, this growth is more than the sign of a healthy company . . . it's living proof of a healthy country. For it again demonstrates the rich harvest of a system in which government, industry, and all citizens share an interest and an obligation toward each other.

CITIES SERVICE

Progress through Service



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BAASH-ROSS makes Kellys in all sizes—all designs (square, hexagon and octagon) and all lengths... plus incorporating the most advanced construction and metallurgical features. No effort is spared to insure you that a B-R Kelly is the very best that money can buy.

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So, compare low first cost per working hp of these new International units with any other make. And compare such International *bonus* features as positive, unfailing lubrication through rifle-drilled oil passages... famous International valve-in-head operating efficiency ...power-smoothing, counter-balanced forged crankshafts ...and positive, "filter-clean" crankcase ventilation. Prove you'll get more dependable hp per dollar...more profits to depend on from every dollar you invest. Compare soon—see your International power unit distributor.

Brief Specifications (Gasoline)*

Model	Net hp and rpm	Max. torque lbs.-ft.	Displacement	Bore & Stroke
U-220	68 @ 2400	177	220.5	3 9/16 x 3 11/16
U-264-6	78 @ 2400	192	264.3	3 11/16 x 4 1/8
U-308	87.5 @ 2400	229.5	308.2	3 13/16 x 4 1/2
U-372	104 @ 2200	288	372	4 3/8 x 4 1/8
U-450	126 @ 2200	323	450.9	4 3/8 x 5
U-501	133 @ 2200	384	500	4 1/2 x 5 1/4

*Complete specifications and ratings on LPG and natural gas available on request.

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Easy to Open • Low Maintenance • Proved Design

No lubrication is needed to hold a tight seal in the BIW valve. But, even more important than this economy is the valve's complete dependability. It's always ready to open or to close. The simplified design of the BIW Non-Lubricated Gate Valve assures years of trouble-free operation. Design has been proved by more than 35,000 installations. The metal-to-metal seal and low opening torque even when the valve is under pressure are important advantages, important now and for the years ahead. The BIW valve is only part of the complete BIW Christmas tree. Oil tool sales office: 1404 Dunlavy, Houston 19, Texas, JAckson 9-4221.

ALCO

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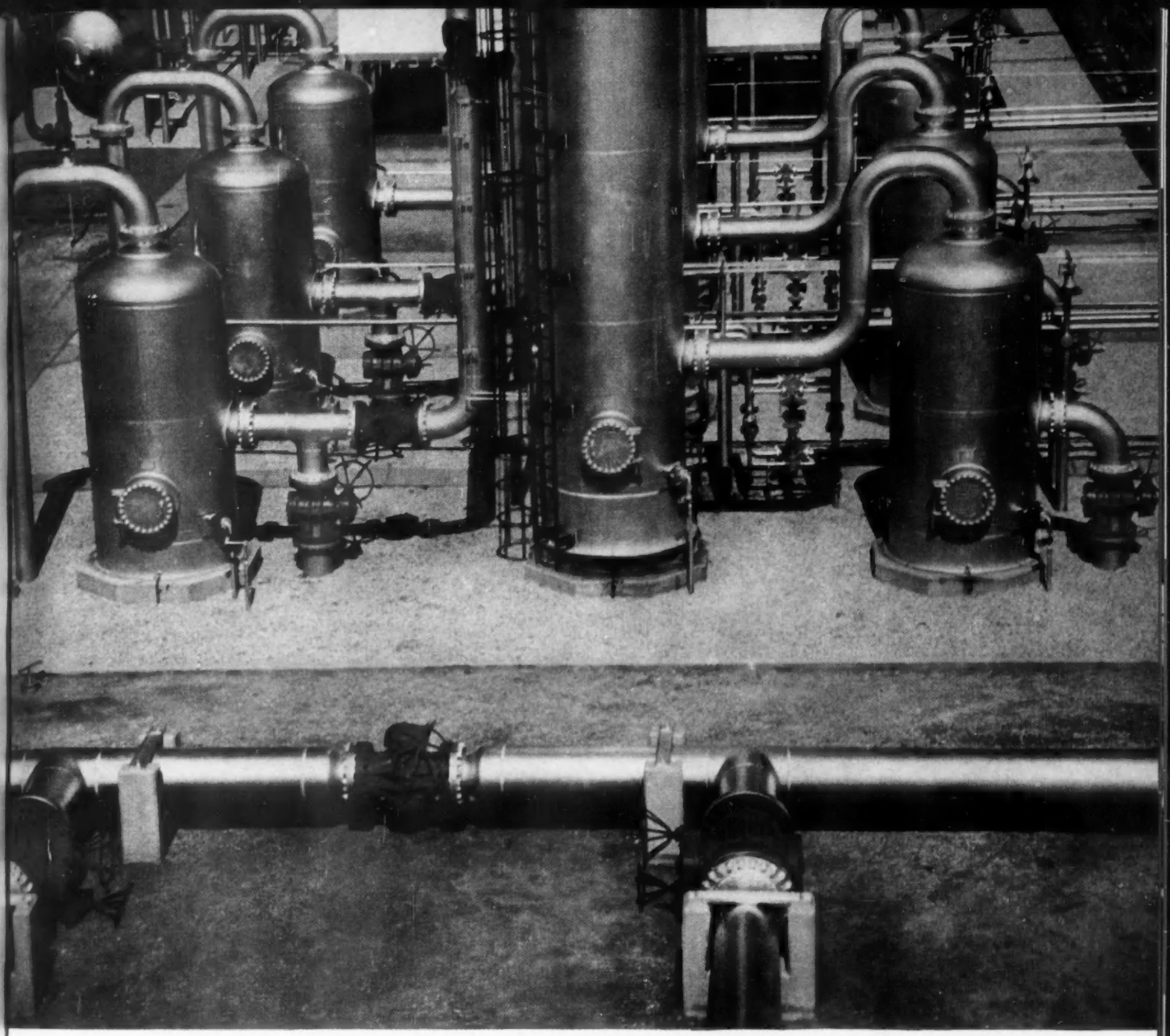

How much does safety cost?

You don't pay extra for the inherent safety of Rockwell-Nordstrom valves. Actually, their price is often lower than ordinary valves. Their cost to use, year after year, is much lower because lubricant stops trouble before it starts.

Forty years of outstanding performance have proven you can't buy a safer valve than Rockwell-Nordstrom. Pressurized lubricant sealing means positive, leakproof control on lightest gases. Streamlined thru-port design minimizes pressure loss on even heavy slurries. Quarter-turn operation is two to five times faster than ordinary valves. You *know* you are safe when you specify Rockwell-Nordstrom valves. Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.

Available at leading suppliers . . . everywhere.

ROCKWELL-Nordstrom **VALVES**

Lubricant Sealed for Positive Shut-off

40th Year *of lubricated plug valve leadership*

For power operation . . . clearly superior

Rockwell-Nordstrom valves' quarter-turn operation allows the use of less complicated (and less costly) operators. Lubrication greatly reduces torque. The thin, tough film of *pressurized* lubricant that forms the leakproof seal also cuts maintenance and down time by stopping trouble before it starts.

For electric, pneumatic or cylinder operation, Rockwell-Nordstrom valves perform better, longer, for less money. For more information, write: Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.

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ROCKWELL-Nordstrom VALVES

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TYSCO announces the addition of a complete line of spherical oil and gas separators. Various capacity ranges are available in five working pressures.

Offering better accessibility, more convenient location of controls, and greater ease in hook-up and liquid level adjustment, the TYSCO Spherical Separator also provides a new high standard of separator efficiency. Larger oil-gas interface and the superior TYSCO mist-extractor combine in this compact separator design to produce drier gas and thoroughly de-gassed oil.

Ask to see full engineering specifications on the TYSCO Spherical Separator today. Call the TYSON SMITH COMPANY, UNderwood 9-1425, Houston, Texas.

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Right : Aden Refinery.

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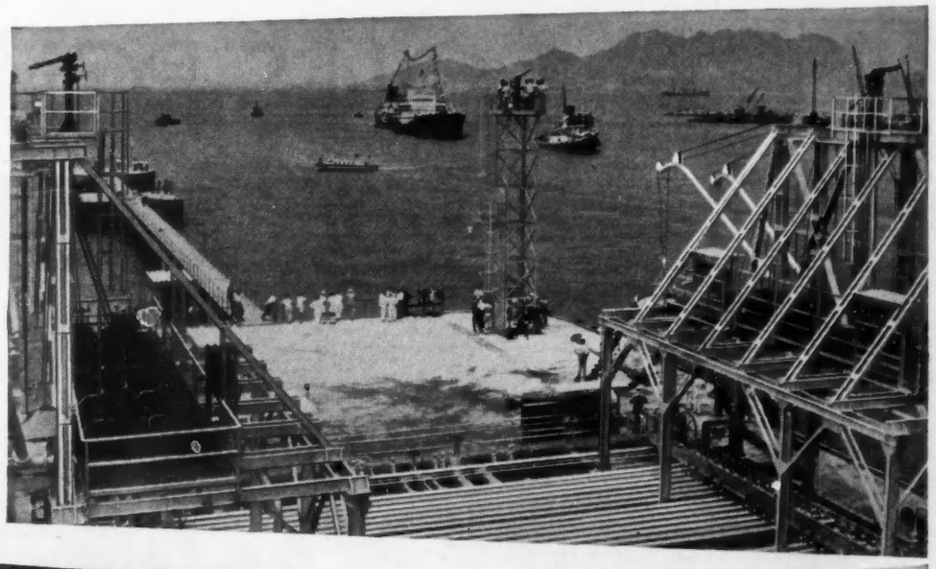
Bottom : Kwinana Refinery, Australia.



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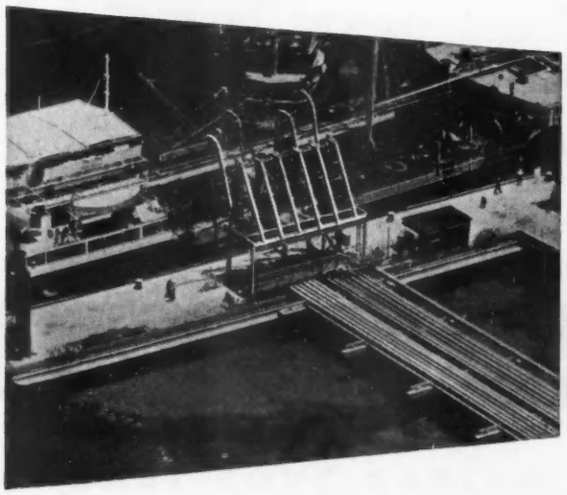

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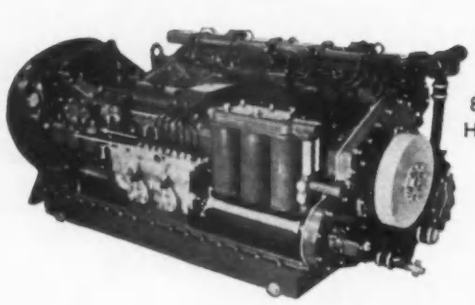
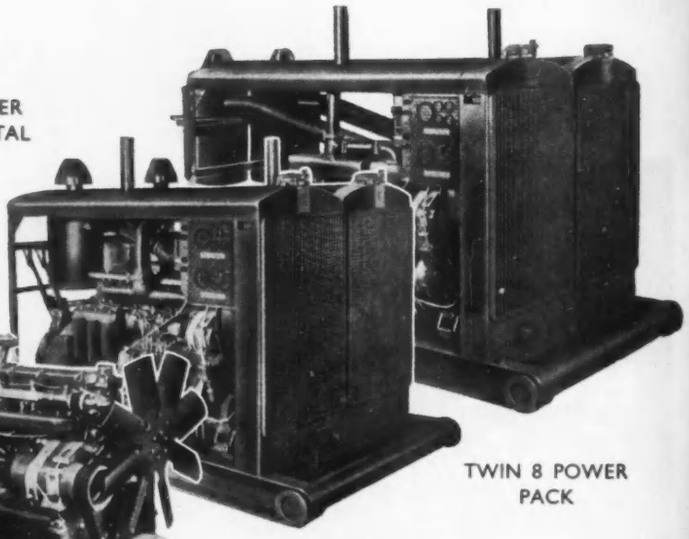
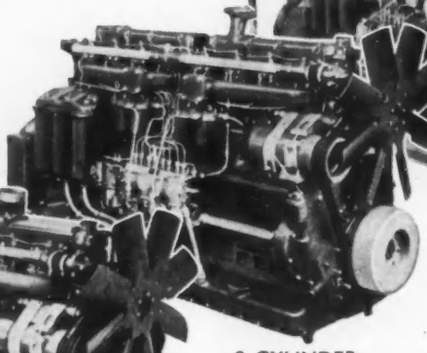


8 CYLINDER
HORIZONTAL



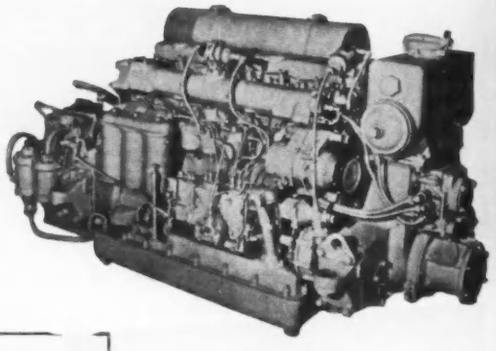
TWIN 8 POWER
PACK



TWIN 6 POWER
PACK

8 CYLINDER
100-333 b.h.p.

6 CYLINDER
80-275 b.h.p.



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The Laboratory Training Instructor is a well rounded Magcobar man. He's a highly trained technician, he's worked in the field as a mud engineer, he's abreast of the latest developments in mud research and he's a teacher. This is the man that puts the final polish on the mud engineers before they complete their training in the field. He teaches them how muds are compounded and why—what chemicals to use, how to formulate the proper combination of weighting materials and chemicals under all types of drilling conditions. In short, how to take care of any conditions that will arise in your drilling operations. The laboratory training instructor is a vital key in the Magcobar organization that has more than 400 men in the field furnishing the oil industry the most complete drilling mud service in the business.

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to reduce your odds of cleaning out troublesome junk . . .

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K & G Magnetic Fishing Tools

and be sure of maximum recovery . . .

Fishing for lost junk several thousand feet down the hole doesn't have to be a gamble, if K & G Magnetic Fishing Tools are used to minimize your problem. The powerful K & G Drill Pipe Junk Shot can be circulated down until actual contact is made with the fish. Detonation of the shot efficiently breaks up large rock bits, slips, and other hard-to-recover junk which can then be easily recovered by the K & G Magnetic Fishing Tool . . . first and still most successful tool of its type in the field. These tools are available in a complete range of sizes from 1¾" through 11¾", for every size fishing job. The K & G Adjustable Diamond Core Barrel Magnets protect costly core heads, speed coring. Available in popular sizes to run inside the inner barrel of various makes, types and sizes of core barrels, K & G Core Barrel Magnets travel up the inner barrel as the core is cut, carrying small junk recovered . . . protecting costly diamond core heads.

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McCullough Log Enables Precision Perforating of 5′ Pay Zone

Discovers 8′ Error in Electric Log and Casing Measurements

Operator of this old well ran an electric log which located a new, possibly productive, 5′ sand.

McCullough was then called to run a Neutron Log. The Neutron curve confirmed the productive possibilities of the new zone, but also discovered that both the electric log and casing measurements were 8′ in error.

The well was plugged back to 6800′ and perforated according to McCullough measurements.

Thirty ½" improved Ogival Bullets were shot in the 5′ sand in one run by a 3½" O.D. McCullough M-3 Gun. Casing was 5½" O.D. 17 lb.

The well started flowing through the casing before the M-3 Gun was out of the hole.

If the McCullough Radiation Well Logger had not discovered the 8′ measurement error, the 30 shots would have missed the pay zone entirely.

It always pays to rely on the accuracy and dependability of McCullough's Radiation Well Logger.

McCullough Log Locates and Defines 11 New Pay Zones

Accuracy of McCullough Radiation Well Logger Permits Sharp Shooting of 11 Thin Zones for 138 B/D Increased Production

This was an old well in an established California oil field. Production had fallen to five barrels of oil per day.

Believing better production was possible, the operator decided to log and re-perforate the well. McCullough's combination Gamma Ray-Neutron Log was run from 4380′ to 5645′, locating several small, promising stringers of untried sands above the original pay zones.

A simultaneous collar log accurately located casing collars in relation to these thin sands, thus assuring "pin-point" accuracy in perforating.

The two original producing sands were re-shot, four holes per foot, with 26 improved ½" Ogival Bullets from McCullough M-3 Guns and with 26 McCullough Standard Casing Glass Jets.

Above these zones were the 11 small sand stringers ranging in thickness from 4 feet to 13 feet. Intermediate zones, lying between the productive sands, which were not to be perforated ranged in thickness from 5 feet to 103 feet.

Accurate measurement means "putting the shots where they count"... and the "pin-point" accuracy of the McCullough Radiation Well Logger makes sharp shooting of thin zones practical... assures uniform perforating coverage of any zone, thick or thin.

The 11 pay sands were perforated with 256 shots, four holes per foot, by 3½" O.D. McCullough M-3 Perforators firing ½" Ogival Bullets. Production increased from 5 to 143 barrels of oil per day.

This is only one of many actual jobs where the accurate, reliable, easily interpreted information provided by the McCullough Radiation Well Logger has located and defined multiple pay zones, tied-in casing collar locations and permitted precision perforating for best possible production.

McCullough® TOOL COMPANY

Cable Address: MACTOOL

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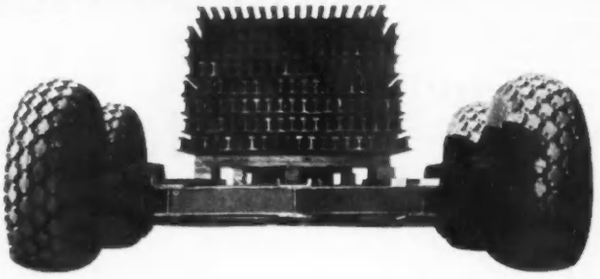
Tail Board Rollers
Suspensions

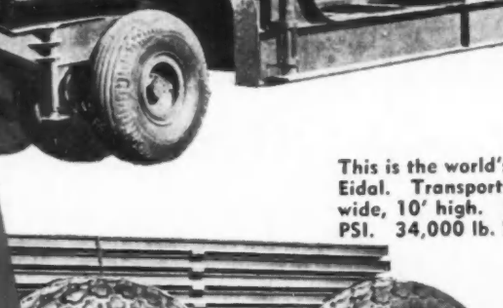


Here Eidal's mammoth low bed trailer is loaded with a test load of 125 tons of railroad rails. With this tonnage the giant trailer can move with relative ease over rugged terrain.

With over 20 years experience in building off road trailers, Eidal gives you true off road trailers with greater capacities, more ability.

This is the world's largest low bed trailer designed and built by Eidal. Transports 150 tons across country. 80' - 6" long, 20' wide, 10' high. Extremely low ground bearing pressure of 3 PSI. 34,000 lb. load imposed on tractor fifth wheel.

Note massive walking beam, spindle and tires. Under a full load approximately 140,000 lbs. are transmitted through the spindle to the tires. These 36:00 x 40 tubeless tires are mounted on Eidal designed and manufactured wheels.



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Rolls-Royce Engines

Rolls-Royce Limited, Oil Engine division, has put out a new brochure describing four of their engines. Power curves are also shown.

To get a copy, circle **No. E16** on Reader's Service Card, last page this issue.

Generator Brochure

The Detroit Diesel Engine division of General Motors has issued a new brochure outlining its complete line of electric generator sets.

The new brochure includes specifications and illustrations of over 25 radiator- and heat exchanger-cooled models ranging from 20 to 245 KW. Both 50 and 60 cycle and direct current units for emergency standby and continuous off-the-line use are represented. Features of the two-cycle Detroit Diesel engines which operate the sets and automatic starting and shut-down equipment are fully covered.

To get a copy, circle **No. E17** on Reader's Service Card, last page this issue.

Speed Reducing Brochure

A new booklet, entitled "Speed Reducer Engineering Manual," is available from the Westinghouse Electric Corporation. The manual presents complete application information such as horse power ratings, torque capacity, overhung load values, dimensions, construction features, installation and maintenance for single, double and triple reduction. Speed reducers may be driven by electric motors, gas, oil or diesel engines.

To get a copy, circle **No. E18** on Reader's Service Card, last page this issue.

IOOC Booklet

A new publication, "Oil Conservation—A Vital Necessity," has been released by the Interstate Oil Compact Commission. This two-color, 16-page pamphlet contains pictures of the governors of the member states of the Compact Commission and brief statements over their signatures concerning the necessity for oil and gas conservation, adequate state conservation laws, and the benefits derived from such laws in the individual states.

To get a copy, circle **No. E19** on Reader's Service Card, last page this issue.

Management Reprints

Operations Research Institute, Inc., is offering reprints of an article entitled, "Management Can Understand Operations Research." Using the question and answer technique, the article gives a down-to-earth explanation of linear programming, one of the war-born analysis techniques which industry is now using to simplify and improve such operations as inventory control, production scheduling, sales forecasting, transportation scheduling, etc.

A typical problem worked out in the article schedules the work of several machines of varying capacities in such a manner that a number of different parts are produced within a prescribed time limit. Only simple arithmetic is used.

To get a copy, circle **No. E20** on Reader's Service Card, last page this issue.

DC Motor Bulletin

Direct-current motors, ½ through 200 horsepower, and motor-generator sets up through 200-kw output are described in a new bulletin released by Allis-Chalmers Manufacturing Company.

The bulletin covers shunt and stabilized shunt wound, compound wound and series wound motors in eight different enclosures plus a matching line of motor-generator sets for reliable conversion of ac to dc current.

Included in the bulletin is a cutaway view of one of the motors showing end brackets, bearings, commutator, windings, commutating poles, brush holders, conduit box, and ventilation, along with line drawings showing a variety of frame sizes.

To get a copy, circle **No. E21** on Reader's Service Card, last page this issue.

M-3 Bullet Perforator

A new eight-page bulletin featuring results obtained with the improved M-3 bullet perforator is now available, according to a McCullough Tool Company announcement.

The new bulletin describes 13 actual perforating jobs performed under all types of conditions in the U. S. and Canada. The versatility of the M-3 bullet gun and its capabilities under varied operating conditions is shown in this collection of recent job reports.

To get a copy, circle **No. E22** on Reader's Service Card, last page this issue.

Rust Preventative Book

Valvoline has available a new 16-page book explaining how to solve the problems of rust with Valvoline Tectyl Rust Preventives and Rust Removers. Chapters are devoted to: The Problem of Rust; Cleaning the Product; Materials in Corrosion Preventives; and How to Choose a Rust Preventive.

Inserted in a convenient pocket on the back cover are five comparison charts on Valvoline Rust Preventives, three giving pertinent data on U. S. Government approved packaging and preservatives, and two on industrial rust preventives. Each comparison chart gives the following information: nature of coating and description; film thickness in inches; approximate square foot coverage per gallon or per pound; approximate air drying time; application method and temperature; suggested method of removal; complete Valvoline Tectyl Rust Preventive description; and its particular use in industrial applications.

Also included is a handy questionnaire for use in giving pertinent information for each particular industrial rust problem, which Valvoline engineers will then review and make specific recommendations.

To get a copy, circle **No. E23** on Reader's Service Card, last page this issue.

Plastic Pipe Study

A new study covering plastic pipe and the paraffin build-up problem was announced this week by Southwestern Plastic Pipe Company, Mineral Wells, Texas. The new study covers field tests using Tenite Butyrate plastic pipe in high paraffin areas where ordinary pipe plugged quickly. Engineering reports and case histories are also used in the study.

To get a copy, circle **No. E24** on Reader's Service Card, last page this issue.

Drilling Mud Emulsifier

A new, 8-page technical bulletin on Seeco-Mul, a drilling mud additive, has been published by Crossett Chemical Company, Crossett, Ark. Seeco-Mul, a wood products derivative, is a comparatively new emulsifying compound widely used on the Gulf Coast and in West Texas.

The bulletin contains maintenance costs and performance comparisons of Seeco-Mul emulsifier mud systems and conventional emulsion muds, chemical analyses of the compound, and other mud engineering data. The text of the literature also lists operating advantages of the emulsifier.

To get a copy, circle **No. E25** on Reader's Service Card, last page this issue.

Wire Rope and Fittings

Just announced is a new catalog of many swaged wire rope assemblies. These assemblies consist of a length of preformed wire rope with a terminal attached to one or both ends. Each end can be a different terminal fitting such as a threaded stud, oval eye, pin eye, clevis, hook, fork, turnbuckle, etc.

New 24-page 8½ x 11 catalog gives all dimensions, drawings, capacities, sizes of both terminals and wire rope. It is called "Industrial Standards Macwhyte 'Safe-Lock' Wire Rope Assemblies," and the catalog number is 5601. Available free from Macwhyte Company.

To get a copy, circle **No. E26** on Reader's Service Card, last page this issue.

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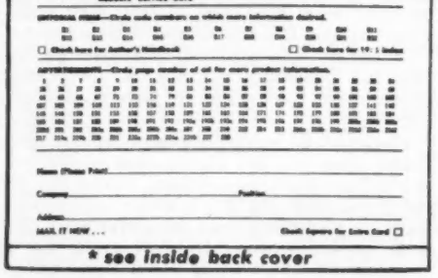

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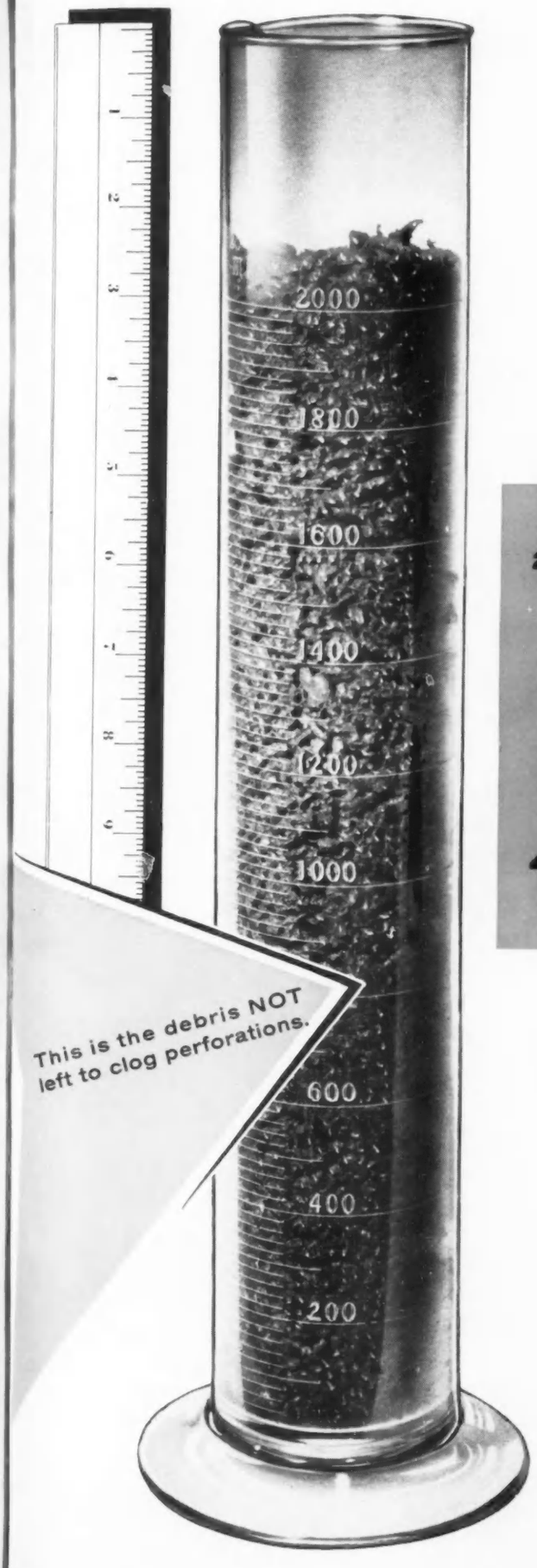

Lane-Wells

POWER-PAK CHARGES

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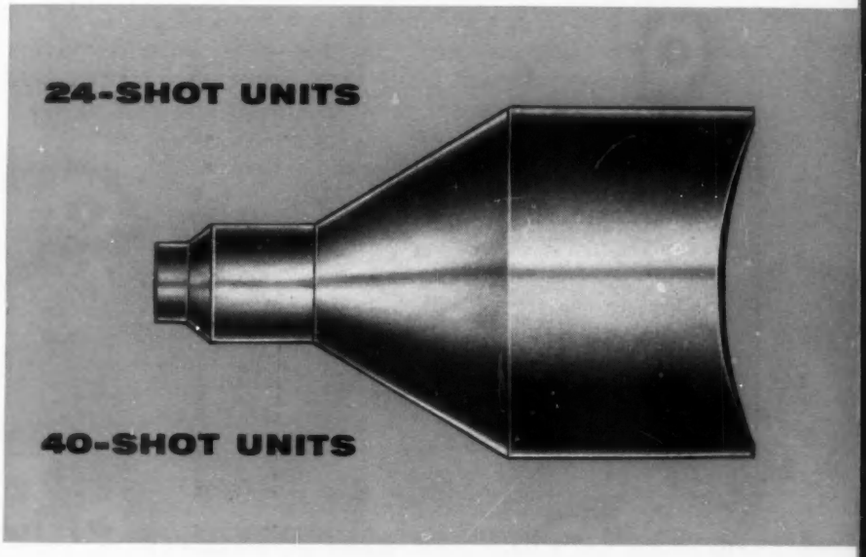

Lane-Wells designed and perfected Karrotfree Koneshot Perforating to give the industry cleaner perforations without loss of penetration. Power-Pak Koneshot charge design gives you all the advantages of Karrotfree perforating plus, on actual test, deeper clean, debris-free perforations.

Power-Pak perforating, an original exclusive Lane-Wells development, is available only through Lane-Wells Branches. For consistently better perforating results, call Lane-Wells and "get the job done right."

LANE WELLS COMPANY

General Offices, Export Office and Plant
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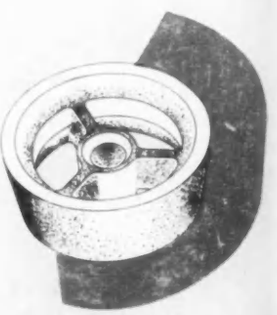
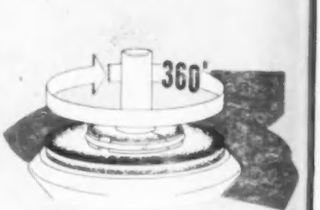
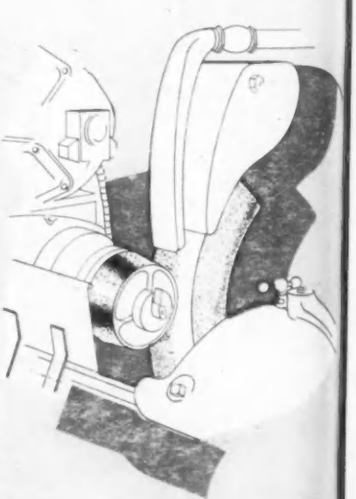
Packaged for easy storage in the supply house . . . and protection against rough treatment and weather in the tool house.



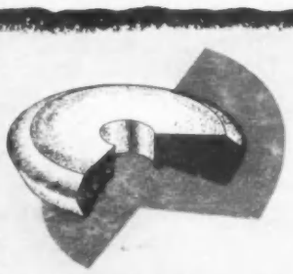
Three-web design of American Iron Valve Seats enables seats to absorb terrific pounding of modern high pressure pumps while providing maximum fluid passage.



Split-ring retainer is standard equipment. This retainer gives 360° support to insert, preventing chipping or cracking of rubber compound.



American Iron Seats are precision ground for perfect seal in pump port. No other production method gives the perfect seating surface as this automatic honing machine.



Compound 808 Insert, the finest available in composition and design, has high resistance to low aniline point oils. The rounded lip assures smoother running pumps and higher pump efficiency.

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